GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

FINAL
Coal Ash Impoundment – Specific Site Assessment Report
PPL Montana
Colstrip Power Plant

Submitted to:
Lockheed-Martin Corporation
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Submitted by:
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1.0 Introduction

1.1 Purpose

This report presents the results of a specific site assessment of the dam safety of the Units 1 & 2 Bottom Ash Ponds, Units 1 & 2 Pond “A”, Units 1 & 2 Stage Two Evaporation Pond (STEP) and Units 3 & 4 Effluent Holding Pond (EHP) coal combustion waste impoundments at PPL Montana’s Colstrip Power Plant. The assessments were completed on June 2 and 3, 2009.

These impoundments were assessed because their failure may result in significant economic loss, environmental damage, disruption of lifeline facilities or loss of life (significant or high hazard according to U.S. Environmental Protection Agency (EPA) classification). The specific site assessment was performed with reference to Federal Emergency Management Agency (FEMA) guidelines for dam safety, which includes other federal agency guidelines and regulations (such as U.S. Army Corps of Engineers and U.S. Bureau of Reclamation) for specific issues, and defaults to state requirements where not specifically addressed by federal guidance or if the state requirements were more stringent.

1.2 Scope of Work

The scope of work between GEI and Lockheed-Martin Corporation for the site assessment is summarized in the following tasks:

1. Acquire and review existing reports and drawings relating to the safety of the project provided by the EPA and Owners.

2. Conduct detailed physical inspections of the project facilities. While on-site, fill out Field Assessment Check Lists provided by EPA for each management unit being assessed.

3. Review and evaluate stability analyses of the project’s coal combustion waste impoundment structures.

4. Review the appropriateness of the inflow design flood (IDF), and adequacy of spillways or ability to store IDF, including considering the hazard potential in light of conditions observed during the inspections or to the downstream channel.

5. Review existing performance monitoring programs and recommend any additional monitoring required.

6. Review existing geologic assessments for the projects.

7. Submit draft and final reports.

1.3 Authorization

GEI Consultants, Inc. performed the coal combustion waste impoundment assessment for the EPA as a subcontractor to Lockheed Martin who is a contractor to the EPA. This work was authorized by Lockheed-Martin under P.O. No.: 7100052068; EAC #0-381 between Lockheed-Martin and GEI Consultants, Inc. (GEI), dated June 5, 2009.

1.4 Project Personnel

The scope of work for this task order was completed by the following personnel from GEI:

Stephen G. Brown, P.E.	Project Manager/Task Leader
Mary Nodine, P.E.	Staff Geotechnical Engineer
Dan Johnson, P.E.	Senior Technical Review

Program Manager for the EPA was Stephen Hoffman. Program Manager for Lockheed-Martin Corporation was Dennis Miller.

1.5 Limitation of Liability

This report summarizes the assessment of dam safety of the identified coal combustion waste impoundments at the Colstrip Power Plant. The purpose of each assessment is to evaluate the structural integrity of the impoundments and provide summaries and recommendations based on engineering judgment. GEI used a professional standard of practice to review, analyze, and apply pertinent data. No warrantees, express or implied, are provided by GEI. Reuse of this report for any other purpose, in part or in whole, is at the sole risk of the user.

1.6 Prior Inspections

PPL Montana personnel indicated that because the Colstrip Power Plant is under a major facilities permit, it is their understanding that the Montana Dam Safety Program rules do not apply to the impoundments on site. PPL Montana regularly conducts informal, internal inspections of their impoundments, including daily drive-by inspections of the downstream toes and the crests of all dams as well as quarterly walking inspections. PPL Montana also voluntarily engages consultants to inspect the dams at approximately 5-year intervals. Inspections were performed in 1988 by Chen-Northern, Inc. of Billings, Montana; in 2005 by Maxim Technologies of Helena, Montana; and in 2009 by Hydrometrics of Billings, Montana.

2.0 Description of Project Facilities

2.1 General

The Colstrip facility is a coal-fired power plant located in southeastern Montana in the town of Colstrip in Rosebud County (Figure 1). The Colstrip power plant is jointly owned by PPL Montana, LLC, a subsidiary of PPL Generation, LLC, as well as Puget Sound Energy, Inc., Portland General Electric Company, Avista Corporation, PacifiCorp, and North Western Energy, LLC. The power plant is composed of four units with a total generating capacity of 2,094 megawatts (MW). Units 1 and 2 began operation in 1975 and 1976 and have capacities of 307 MW each. Units 3 and 4 began operating in 1984 and 1986 and have capacities of 740 MW each. The power plant is located on Armell's Creek, a tributary of the Yellowstone River.

The Colstrip power plant has several impoundments located adjacent to the power plant (termed "on-site" ponds herein) including:

- Units 1 & 2 Bottom Ash Ponds;
- Units 1 & 2 Ponds "A", "B" and "C";
- Units 3 & 4 Scrubber Drain Collection;
- Units 3 & 4 Scrubber Wash Tray; and
- Units 3 & 4 Bottom Ash Ponds.

Of these on-site ponds, only the Units 1 & 2 Pond "A" and the Units 1 & 2 Bottom Ash Pond were considered by PPL to be significant hazard impoundments, with the potential for flooding of the town of Colstrip and potential loss of life following a breach. The remaining ponds are not included in this report because they are considered to be low- or less-than-low hazard, either because they have been removed from service or are closed, they are incised (all material storage capacity is below grade), the storage capacity is small, and/or their contained coal combustion waste materials are not likely to travel a significant distance within or outside the plant in the event of a spill.

In addition to the on-site impoundments, the Colstrip plant has two major impoundments located several miles from the power plant. The Units 1 & 2 Stage Two Evaporation Pond (STEP) is located approximately two miles northwest of the plant, and the Units 3 & 4 Effluent Holding Pond (EHP) is located approximately 3.5 miles southeast of the plant. The Units 1 & 2 STEP was classified as a high hazard impoundment due to the potential for loss of life in the event of a dam breach because of the close proximity of residences within the flood inundation area. The Units 3 & 4 EHP was classified as Low Hazard based on an inundation study (Maxim, 2005). However, GEI recommends the EHP be reclassified as Significant Hazard based on the likelihood of significant economic/environmental cost associated with a dam breach. As a result, the Units 3 & 4 EHP was included in the specific site assessment. An overall view of all onsite and offsite ponds is shown on the aerial photograph (Figure 2).

2.2 Dams and Reservoirs

The Colstrip plant includes several large coal combustion waste dams at the two off-site impoundments, as well as smaller embankments associated with the on-site ponds. The dams included in this report are:

- Units 1 & 2 Bottom Ash Ponds – west, north, and east embankments
- Units 1 & 2 Pond "A" – west embankment
- Units 1 & 2 STEP Dam
- Units 3 & 4 EHP
    - Main Dam
    - Saddle Dam

The Units 1 & 2 Bottom Ash Ponds and the Units 1 & 2 Pond "A" are surrounded by a continuous embankment. This earth embankment extends along the west side of Pond "A", and continues north to bound the west, north, and east sides of the Bottom Ash Ponds. The configuration of these on-site impoundments is shown in (Figure 3). The embankment has a maximum height of approximately 25 feet, with a 20-foot-wide crest and approximately 2H:1V side slopes. The total length of the embankment is about 4,000 feet. Cross-sections of the Bottom Ash Ponds and Pond "A" are shown in Exhibit 1.

The Units 1 & 2 Bottom Ash Ponds are divided into two cells. The east cell stores bottom ash and boiler slag at various stages of clarification, and the water remaining after the ash settles out is transferred to the west clearwell cell. These ponds have a surface area of about 7 acres and a total storage capacity of about 73 acre-feet. The clearwell cell is double-lined with 45 millimeter (mm) reinforced polypropylene (RFP) liners and a leachate collection system. The east cell is clay-lined.

The Units 1 & 2 Pond "A" is currently used to store clean water from stormwater runoff, though the southern portion of the pond contains a small quantity of fly ash and flue gas desulfurization (FGD) solids. The fly ash/FGD solids are covered by a geosynthetic clay liner (GCL) and several feet thickness of bottom ash. Prior to 2005, Pond "A" was the western portion of a U-shaped pond that also included the "B" fly ash pond to the east. A bottom ash dike was constructed in 2005 to separate the ponds. At this time, an RFP liner was installed in the "B" pond to prepare it for continued fly ash/FGD storage, while the "A" pond remained clay-lined for the purpose of storm water storage. The “A” pond has a surface area of about 14 acres and a storage capacity of about 245 acre-feet.

The Units 1 & 2 STEP has a total surface area of 176 acres and a total storage capacity of about 4,370 acre-feet at the normal operating pool of El. 3,270. The pond is divided into five cells as shown in the plan on Figure 4. Three of the cells are currently in use. All cells have single high density polyethylene (HDPE) liners with the exception of Cell “B”, which has a double, 45 mil reinforced polyethylene (RFP) liner with leak detection and leachate collection systems. The STEP currently, and in the past, stores fly ash and flue gas desulphurization (FGD) solids. The coal combustion waste is pumped into the pond as a slurry, and the water is decanted and pumped back to the Colstrip plant for reuse. The remaining fly ash/FGD slurry solidifies as evaporation occurs.

The Units 1 & 2 STEP Dam was constructed in 1992 and is 2,400 feet long with a maximum height of 88 feet, a 25-foot-wide crest and 3H:1V side slopes. The dam crest is at El. 3,278, providing 8 feet of freeboard above the normal pool elevation. The dam is constructed of earth fill and has a zoned cross section with a central core extending to bedrock in a core trench. The dam also features a grout curtain extending up to 80 feet below the core trench for seepage control. An upstream low-permeability soil blanket was constructed on the left abutment area to reduce potential seepage. A chimney drain, blanket drain and toe drain collect and control seepage that moves through the dam. A valley drain system collects surface water, groundwater, and potential seepage and returns it to the ponds. The STEP Dam is located about 3000 feet downstream of the Stage One Evaporation Pond and its associated dam, which was completed in 1977 and has been completely filled with coal combustion waste. The area has since been reclaimed and is currently used as pasture land. A plan and profile of the STEP Dam is shown in Exhibit 2, and typical sections are shown in Exhibit 3.

The Units 3 & 4 EHP has a planned total surface area of 367 acres and a storage capacity of about 17,000 acre-feet at the normal operating pool of El. 3,280. The pond is divided into eight cells storing plant coal combustion waste including fly ash, bottom ash, boiler slag, FGD residuals, mill residuals, and boiler water-side cleaning chemicals. The general plan for the Units 3 & 4 EHP is shown in Figure 5. Since 2004, the fly ash/FGD slurry stored in the Units 3 & 4 EHP is mostly deposited in a concentrated form, termed “paste”, which has 68 percent solids, and is made by an on-site paste plant. Prior to construction of the paste plant, the fly ash/FGD solids were deposited in a slurry form that has about 10 to 15 percent solids. Cells “B” and “F” have a lining with a leachate collection system. PPL describes the Areas “B” and “F” lining as being double-contained with a 45 mil RPF lining overlying a minimum 10 foot thick layer of dry paste, with the leachate collection system located between the RFP and the paste layers. The remaining cells are not lined. The entire EHP, which includes several cells, is surrounded by a concrete cutoff wall to control seepage. The cutoff wall is up to 80 feet deep and is keyed 5 feet into claystone or siltstone. Most of the

EHP pond areas are underlain by claystone or siltstone, which also serves to reduce potential seepage.

The Units 3 & 4 EHP has two dams: the Main Dam and the Saddle Dam, which are about 2,300 feet and 3,500 feet long, respectively. The dams were constructed in 1983 and currently have crests at El. 3,262, though future plans include raising both dams to El. 3,290 as described in the design report (Bechtel 1982). The Main Dam has a maximum height of 110 feet and the Saddle Dam has a maximum height of 38 feet. Both dams are operated with greater than ten feet of freeboard. The dams are constructed as zoned rolled earth embankments with central cores extending to bedrock in a core trench. The dams also feature chimney drains, core trench sloping drains, horizontal blanket drains and drainage pipes. The blanket drain is limited in extent to the central third (highest sections) of the dam. A valley drain system downstream of the dams collects surface water, groundwater and potential seepage for pumping back to the reservoir. Plans and profiles of the Main and Saddle Dams are shown in Exhibits 4 and 5. Typical sections and details are shown in Exhibit 6.

Information concerning the dams at the Colstrip facility is presented in Table 1.

Table 1: Colstrip Power Plant - Dam Parameters Summary

Parameter	Value				
Dam	Units 1 & 2 Bottom Ash Pond Embankment	Units 1 & 2 "A" Pond Embankment	Units 1 & 2 STEP Dam	Units 3 & 4 EHP Main Dam*	Units 3 & 4 EHP Saddle Dam*
Height (ft)	25	25	88	110	38
Length (ft)	~2,000	~2,000	2,400	2,300	3,500
Crest Width (ft)	20	20	20	136	153
Crest Elevation (ft)	3,264	3,264	3,278	3,262	3,262
Side Slopes	2H:1V	2H:1V	3H:1V	3H:1V	3H:1V
Operating Pool El. (ft)	3,260	3,260	3,270	3,237	3,237
Normal Storage Volume (ac-ft)	73	38.4	4,370	Est. 10,000	
Normal Surface Area (acres)	7	7.6	176	Est. 300	

*Note: Final storage capacity for the Units 3 & 4 EHP will be 17,000 acre-feet and area 367 acres after 28-foot raise to El. 3,290. No area-capacity curve was available for the estimate.

2.3 Spillways

The on-site storage ponds do not have spillways. These ponds are designed to have a minimum 4 feet of freeboard, which is considered sufficient to impound the 24-hour probably maximum flood (PMF) (24 inches) and is expected to be sufficient to impound the remaining rainfall which is included in the 72-hour PMF.

The Units 1 & 2 STEP has an emergency spillway at El. 3,274.6 which was originally designed to prevent the dam from overtopping in the unlikely event that the 24-hour PMF occurs subsequent to the 100-year flood. The spillway is an uncontrolled, unlined, earth channel excavated into the left abutment (looking downstream) of the embankment. The spillway is approximately 100 feet long and 25 feet wide. The PMF was updated in 1988, when the HMR was revised, to be associated with the 72-hour probable maximum precipitation (PMP) rather than the 24-hour PMP. Routing the 72-hour PMF results in a small portion (50 acre-feet) to be discharged through the emergency spillway.

The Units 3 & 4 EHP does not currently have an emergency spillway, though when the dam is raised to its final height, an emergency spillway at El. 3,286.1 is planned to prevent the dam from overtopping should the 24-hour PMF and the 100-year flood occur in succession. The planned spillway consists of a gabion-lined channel with a 50-foot-wide crest. The current dam configuration provides over 20 feet of freeboard and is capable of storing the PMF.

A summary of the spillway parameters is presented in Table 2.

Table 2: Colstrip Power Plant - Spillway Parameters Summary

Parameter	Value	
Reservoir	Units 1 & 2 STEP	Units 3 & 4 EHP
Spillway Length (ft)	~200	None
Crest Elevation (ft)	3,274.6	None
Crest Width (ft)	25	N/A
Side Slopes	Unknown	N/A

2.4 Intakes and Outlet Works

There are no intake or outlet work structures associated with the ponds at the Colstrip facility. Water levels are controlled by changing the pumping rate of ash slurry or paste into the ponds or by diverting the ash slurry or paste to an available pond. Water is only removed from the ponds through evaporation and, in un-lined ponds, seepage.

2.5 Drains

PPL Montana personnel indicated that the on-site ponds have a system of toe drains that drain into a valley drain system. Water is then collected and pumped back into the ponds.

The Units 1 & 2 STEP Dam has chimney drains, inclined drains and horizontal drainage blankets on the downstream side of the embankments to collect seepage. Seepage collected by the aforementioned drains is directed to the toe drains, which ultimately drain to a valley drain system. The valley drain system consists of a 20-inch drain pipe extending downstream from the toe of the dam along the stream channel. The pipe discharges into a manhole where water is collected and pumped back to the ponds.

The Units 3 & 4 EHP Dams have chimney drains, inclined drains and horizontal drainage blankets on the downstream side of the embankments to collect seepage. Seepage collected by the aforementioned drains is directed to the toe drains, which ultimately drain to a valley drain system similar to that described above for the Units 1 & 2 STEP Dam.

2.6 Vicinity Map

The Colstrip Power Plant is located within Rosebud County, Montana in the city of Colstrip, as shown on Figure 1. The plant is located in the East ½ of Section 34, Township 2 North, Range 41 East. The Units 1 & 2 STEP is located approximately two miles northwest of the plant, and the Units 3 & 4 EHP is located approximately 3.5 miles southeast of the plant. The Units 1 & 2 STEP is located in Section 29, Township 2 North, Range 21 East. The STEP is located in a dissected stream valley draining into Armell's Creek and ultimately into the Yellowstone River. The Units 3 & 4 EHP is located in Sections 5 and 6, Township 1 North, Range 42 East. The EHP is located on a tributary to Cow Creek.

2.7 Plans and Sectional Drawings

Engineering drawings and reports for various project features are available in the Owner's files. For reference purposes, project plan and sectional drawings from the Owner's files are reproduced in this report as follows:

Bottom and Fly Ash Ponds Sections	Exhibit 1	(Dwg C1-32)
STEP Finished Plan and Profile of Dam	Exhibit 2	(Dwg C1-933)
STEP Typical Sections	Exhibit 3	(Dwg C1-934)
Units 3 & 4 EHP Main Dam Plan and Cross Section	Exhibit 4	(From Chen 1989)
Units 3 & 4 EHP Saddle Dam Plan and Cross Section	Exhibit 5	(From Chen 1989)
Units 3 & 4 EHP Sections and Details	Exhibit 6	(Dwg. C3-0736)

2.8 Standard Operational Procedures

The Colstrip facility is a coal-fired steam generating power plant that provides electric power to millions of customers. The power plant includes two 307 MW units (1 & 2) and two 740 MW units (3 & 4), with a total generating capacity of 2,094 MW. Coal is delivered to the power plant by conveyor systems, where it is then combusted to power the steam turbines. The burning of coal produces several gases which are vented from the boiler, and bottom ash, which is made of coarse fragments, falls to the bottom of the boiler, and is removed along with boiler slag.

The bottom ash from Units 1 and 2 is pumped as a slurry to the on-site ponds just south of the plant. The fly ash/FGD slurry from Units 1 and 2 is slurried and pumped directly to the Units 1 & 2 STEP where it is either deposited as slurry or, in the near future, will be concentrated at the paste plant and deposited as a paste material. Partial settling of bottom ash particulates occurs in the on-site ponds and the remaining clear water is returned to the plant. Some of the bottom ash is reclaimed from the on-site ponds and used for construction of roads and dikes on site. According to PPL, approximately 20,000 tons of bottom ash per year is sold for commercial off-site use. The remaining bottom ash is trucked to the Units 3 & 4 EHP for final storage.

The bottom ash from steam generation Units 3 & 4 is pumped to the on-site bottom ash ponds that are located east of the plant for temporary storage, and ultimately trucked to the Units 3 & 4 EHP for final storage. The fly ash/FGD slurry from steam generation Units 3 & 4 is slurried and pumped directly to the Units 3 & 4 EHP where it is either deposited as slurry or concentrated at the paste plant and deposited as a paste material.

3.0 Summary of Construction History and Operation

The power plant is composed of four units with a total generating capacity of 2,094 MW. Units 1 and 2 began operation in 1975 and 1976 and have capacities of 307 MW each. Units 3 and 4 began operating in 1984 and 1986 and have capacities of 740 MW each.

The on-site ponds, including the Units 1 & 2 Bottom Ash Ponds and Pond “A”, were designed and constructed at the same time as the coal-fired steam-generation Units 1 & 2 were constructed, in the mid-1970s. Original design and construction reports for these ponds and their embankments are not available. Based on the construction timing, coal combustion waste materials had not yet been produced and the Units 1 & 2 Bottom Ash Ponds and Pond “A” embankments could not have been constructed on coal combustion waste materials. Evidence of prior releases, failures or patchwork construction were not observed during the site visit or disclosed by plant personnel during the site visit. Construction reports were not available for review.

In 2005, the “A” pond was divided by completing constructing of the existing partial dike to form an adjacent “B” pond to the east. The dike was designed by HKM Engineers, and its design and construction is documented in the design report (HKM, 2005). Historically, the Units 1 & 2 “A” pond was used to store fly ash/FGD slurry, with slurry from the plant entering the hydraulically connected “B” pond at the northeast corner. The water flowed south through the “B” pond to flow around the partial dividing dike and then flow north through the “A” pond as the fly ash/FGD solids settled out, depositing some fly ash/FGD solids at the southern end of the “A” pond. Relatively clear water accumulated at the north end of the “A” pond. When the ponds were separated by the dividing dike in 2005, the fly ash/FGD solids that accumulated at the south end of the “A” pond were covered with a geosynthetic clay lining (GCL) and several feet thickness of compacted bottom ash for permanent storage. The “A” pond is currently used for stormwater storage.

The Units 1 & 2 STEP Dam was designed and constructed by Bechtel Engineering in the late 1970s to early 1980s. The embankment is zoned earth fill, with a silt and clay core extending into the sandstone and siltstone bedrock, and a shell consisting of weathered sandstone, siltstone, shale and non-plastic silt. The STEP is located downstream of the Stage One Evaporation Pond (SOEP), which was completely filled with coal combustion waste and reclaimed in the early 1980s.

Our assessment of the pre-construction conditions at the STEP Dam included review of information on the design drawings. The SOEP was constructed at the same time as the Colstrip Power Plant in the mid-1970s. The SOEP was receiving coal combustion waste at the time the STEP was being constructed downstream a few years later. The STEP embankment was constructed on undisturbed land. Foundation preparation for the STEP included removal of a minimum of 1 foot soil depth beneath the entire dam and construction of a key trench through the native soil and into the underlying bedrock. In addition, boreholes drilled prior to construction do not indicate the presence of coal combustion waste materials within the dam alignments. Evidence of prior releases, failures or patchwork construction were not observed during the site visit or disclosed by plant personnel during the site visit. Construction reports were not available for review.

A paste plant is being constructed at the STEP, with expected completion in 2009. Following completion of the paste plant, the plan is to dispose of all fly ash/FGD slurry as paste in the STEP.

The Units 3 & 4 EHP Main Dam and Saddle Dam were designed and constructed by Bechtel Engineering in the early- to mid-1980s. The embankments are zoned earth fill, with low- to medium plasticity silt and clay cores and shells consisting of weathered sandstone, siltstone, shale and non-plastic silt.

Our assessment of the pre-construction conditions at the Units 3 & 4 EHP Main and Saddle Dams included review of information on the design drawings. The Units 3 & 4 EHP dams were constructed on undisturbed land. Boreholes drilled prior to construction do not indicate the presence of coal combustion waste materials within the dam alignments. The design drawings show the dams are to be constructed on native soil/rock materials and that foundation preparation requirements include removal of at least the upper 1 foot of soil beneath the entire dam prior to constructing the dams. Foundation preparation also included construction of a key trench through the native soil and into the underlying bedrock. With exception of the 1999 seepage event through the Saddle Dam, which has been addressed administratively by restricting the water level in the pond, evidence of prior releases, failures or patchwork construction were not observed during the site visit or disclosed by plant personnel during the site visit. Construction reports were not available for review.

The EHP Main and Saddle Dams currently have crests at El. 3,262, but plans include raising the dams 28 feet to the final design height at El. 3,290 and constructing an emergency spillway. A paste plant was constructed at the EHP in 2004 and currently fly ash and FGD is disposed of as paste in the EHP cells. Occasional disposal of fly ash and FGD slurry may occur if the paste plant is out of service for maintenance.

4.0 Geologic and Seismic Considerations

The Colstrip Power Plant and its associated impoundments are located in and near the town of Colstrip in Rosebud County, Montana. This area of Montana is within the Northern Great Plains Physiographic Province, which is characterized by valleys, plains, isolated buttes and long, narrow flat-topped ridges. The region contains steep slopes capped by the resistant baked shale, or “clinker”, prominent in the area. The baked shale was formed by the burning of underlying coal deposits.

The Colstrip region bedrock is part of the Tongue River Member of the Upper Cretaceous to Paleozoic Fort Union Formation. The Tongue River Member is composed of claystone, shale, siltstone, and sandstone with deposits of lignite, coal, and calcareous sedimentary rocks. The rocks in this unit generally dip less than a few degrees to the south-southeast.

Seismic acceleration based on the on the Uniform Building Code Seismic Zone Map maximum ground motion for Rosebud County is 0.05g, which corresponds to an earthquake return period of about 2,500 years. This value is consistent with the United States Geological Survey regional probabilistic ground motion associated with a similar return period.

Site-specific documentation presenting geologic information for the facilities at the Colstrip Power Plant included:

- Portage and HKM 2005 “PPL/Colstrip Fly Ash Pond Design and Construction Report”
- Bechtel 1979 “Second Stage Evaporation Pond Design Report”
- Bechtel 1982 “Effluent Holding Pond Design Report”

Borings drilled near the on-site Units 1&2 Bottom Ash Ponds and Pond “A” indicate that the stratigraphic section includes about 2 feet of surface fill overlying about 10 to 20 feet of predominantly fine-grained soils. The overburden soils are underlain by hard sandstone or shale and intermittent coal. Geotechnical boring logs and detailed geologic information is not available for the on-site ponds.

Borings drilled during the site investigation for the Units 1 & 2 STEP Dam indicate that the stratigraphic section includes up to 35 feet of clayey silt and gravel overburden overlying a one-foot-thick remnant of the McKay Coal Seam, 60 feet of poorly- to moderately-cemented sandstone and siltstone, 25 feet of shale, and alternating moderately-cemented siltstone and shale, with thin lenses of carbon and limestone throughout.

The Units 3 & 4 EHP Dams are situated in an oval-shaped erosional basin within the Fort Union Formation. Baked shale forms the majority of the rim of the basin while sandstone, siltstone and occasional coal and claystone form most of the basin bottom. A thin veneer of residual silty sand and sandy silt blankets most of the area, ranging in thickness from 1 to 18 feet. Interbedded sandstone, siltstone and shale underlie most of the site. The McKay Coal Seam is present within the deeper bedrock and averages about 10 feet thick in the EHP area. The stratigraphic sections of both the Main Dam and the Saddle Dam consist of the highly permeable baked shale overlying lower-permeability bedrock. The baked shale extends from the dam crest El. 3,262 down to about El. 3,230 in the abutments of the Main Dam and is found in both abutments and beneath the Saddle Dam to about El. 3,210. The presence of the permeable baked shale was addressed in the design by a perimeter concrete cutoff wall for seepage control at the Units 3 & 4 EHP site.

5.0 Instrumentation

5.1 Location and Type

A large network of monitoring wells is installed throughout the Colstrip facilities primarily in support of groundwater quality studies. A few of these wells are located in the abutments or near-downstream area of the dams and serve a dual purpose to also monitor seepage. Only a few instruments are purposely assigned for monitoring the performance of the dams. The wells are monitored monthly. Only partial well location or water level data was available for this report. A line of interceptor wells is located just downstream of the dam to pump seepage and groundwater back to the reservoir for groundwater quality purposes.

5.1.1 Units 1 & 2 Bottom Ash and "A" Pond

There are no piezometers or movement monuments installed in the embankments around the Bottom Ash or "A" Pond. Interceptor wells located downstream of the ponds enable groundwater to the collected and pumped back to the ponds.

5.1.2 Units 1 & 2 STEP Dam

There are no piezometers or movement monuments installed in the STEP Dam embankment or abutments. According to the design drawings (Bechtel 1979), four observation wells were installed just downstream of the dam at the time it was constructed, and numerous other wells have since been installed in this area for groundwater quality studies.

Seepage collected by the internal drains and toe drain of the STEP dam is discharged into the valley drain trench, which is an approximately 500-foot-long gravel and perforated pipe trench that terminates in a manhole. Seepage from the dam is comingled with surface water and potentially groundwater, therefore the quantity of seepage collected by the internal drain system is unknown.

5.1.3 Units 3 & 4 EHP Main Dam

Prior to 2001, there were no piezometer instruments in the Main Dam or abutments. Two electric vibrating wire piezometers were installed to obtain pore pressure information near the bottom of the core at a location just downstream of the concrete cutoff wall, and four standpipe piezometers were installed in the abutments at a location just downstream of the cutoff wall to observe groundwater conditions; two in the sandstone and two in the baked shale adjacent to the dam (Hydrometrics, 2001). One of the two vibrating wire piezometers failed one day after installation and has not been replaced. Locations of these instruments are shown in Appendix A.

Seepage collected by the internal drains and toe drain is discharged into the valley drain trench, which is a gravel and perforated pipe trench that passes through a manhole located near the downstream toe. The flow in the manhole was estimated by eye to be about 20 gallons per minute (gpm). Seepage from the dam can potentially be comingled in the valley drain trench with surface water and shallow groundwater, therefore the quantity of the observed seepage flow that is collected by the internal drain system is unknown.

5.1.4 Units 3 & 4 EHP Saddle Dam

PPL Montana provided readings for twenty standpipe piezometers on or near the Units 3 & 4 EHP Saddle Dam, but did not provide locations or depths for these piezometers. Two of the piezometers have readings at approximately the water level of Cell “G” (approx. El. 3,234 in 2009), which is impounded by the saddle dam. The remaining wells show readings about 12 to 20 feet below the water level in Cell “G”. Seepage through the saddle dam embankment would be collected by the internal drains and toe drain and would be discharged to the valley drain, which is a gravel-filled trench with perforated pipe. However, the internal drain and toe drain system have never collected water, even during the 1999 seepage event, because the primary seepage path is within the baked shale dam foundation and through, or around, flaws in the concrete cutoff wall.

5.2 Time Versus Reading Graphs of Data

5.2.1 Units 1 & 2 STEP Dam

We reviewed water level data for the four observation wells located near the downstream toe of the dam. The wells were read monthly starting in 1978 at well EAP-413 and continuing to the present day. Two wells were located near the center of the dam, and one was located on each abutment. The screen interval for the four wells was below the top of the bedrock, and water levels measured in these wells indicated that the piezometric surface was typically below the core trench and within the bedrock. Water levels measured in the wells ranged from El. 3,147 to El. 3,176. The bedrock at the lowest point in the valley is around El. 3,170, and the original ground surface at the lowest point is around El. 3,200. In general, the water levels in the wells remain relatively stable, fluctuating less than 5 feet. However, three of the four wells are influenced by groundwater pumping and had water levels lowered about 5 to 20 feet due to groundwater pumping starting in about 2001.

5.2.2 Units 3 & 4 Main Dam

The 2001 report by Hydrometrics and the 2009 report by Womack Associates, Inc. present data collected at irregular intervals over a 6-year period for the single remaining electric vibrating wire piezometer (636P) installed in the dam core.

The standpipe piezometers installed into the baked shale stratum in the dam abutments were reported to be dry from the time of their installation in June 2001 until December 2001. Additional data provided by PPL Montana indicate that between January 2007 and June 2009, piezometer 638C, which is located in the right abutment downstream of the cutoff wall and screened in the baked shale, measured a water level ranging from El. 3,235 to about 3,239. The water level in 638C appears to be approximately equal to the elevation of the water in the old clearwell (approx. El. 3,237 in 2009) on the upstream side the dam. Data for the period January 2002 to December 2006 was not provided for review.

The two piezometers (644D and 645D) installed into the sandstone in the dam abutments had water levels at El. 3,187 and El. 3,188 in June 2001. Additional data provided by PPL Montana indicate that between January 2007 and April 2009, piezometer 644D, which is located in the right abutment and screened in the sandstone underlying the baked shale, measured water levels ranging from El. 3,142 to El. 3,190, with water levels typically averaging about El. 3,160. The water levels rapidly increased to around El. 3,185 for several months in late 2008 and then subsequently returned to about El. 3,150. Piezometer 645D in the left abutment generally had water levels ranging from about El. 3,170 to 3,179, with a sharp rise water levels measured near El. 3,188 for several months in 2008 before dropping to around El. 3, 172. Piezometers 644D and 645D do not appear to track increases and decreases together versus time, and are not consistent with the steadily rising water level in the old clearwell over time.

The vibrating wire piezometers were installed in borings 636-P and 637-P, which were drilled to final depths of 119 and 111 feet, respectively. Data from piezometer 636-P is tabulated for the period June 2001 to October 2007 and for both piezometers 636-P and 637-P (broken – no readings) for the period June 2001 to December 2001 in Appendix A. Data for standpipe piezometers 638-C and 639-C (in the baked shale) and 644-C and 645-C (in the sandstone) from 2007 to 2009 are also included in Appendix A, as well as water surface elevations surveyed in the ponds in 2009.

5.3 Evaluation

5.3.1 Units 1 & 2 Bottom Ash and Pond "A"

There are no instruments for monitoring the performance of the pond embankments; therefore the instrumentation program does not meet minimum guidance for instrumentation programs in a significant hazard dam.

5.3.2 Units 1 & 2 STEP Dam

There are no instruments for monitoring the internal water pressure, movement, or seepage flow rates at this dam, therefore the instrumentation program does not meet minimum guidance for instrumentation programs in a high hazard dam. Water level information for four observation wells located downstream of the dam indicate the piezometric surface is well below the ground surface and are likely associated with local groundwater levels.

5.3.3 Units 3 & 4 Main Dam

There is only one functioning piezometer available to monitor water pressures internal to the dam embankment, and it is located near the bottom of the dam core. There are two piezometers available to monitor water pressures in the sandstone in the dam abutments and two to monitor water pressures in the baked shale in the dam abutments. The last available reading for the embankment piezometer was in 2007. Data are available for the standpipe piezometers from 2007 to 2009.

Instrumentation was installed in 2001 with the apparent purpose of evaluating a potentially significant dam safety seepage issue: namely that seepage pressures in the sandstone may go around the cutoff wall and act on the downstream shell of the dam embankment. One standpipe piezometer installed in the right abutment in the highly permeable baked shale (638-C) was dry at the time of installation but during the recent few years of data has measured up to 7 feet of water head in the baked shale strata indicating that seepage may be moving to the downstream side of the dam at the right abutment with little or no head loss from the reservoir. In addition, a vibrating wire piezometer (637P) that failed shortly after installation has not been repaired or replaced, thereby leaving only 1 piezometer in the dam embankment and core. The number of instruments and the frequency of monitoring are inadequate to develop a full understanding of the pore pressure conditions in the dam core and downstream shell, or to evaluate changes in conditions over time though some instruments indicate potentially important changes have occurred. In addition, the indication that there could be reservoir seepage on the downstream side of the cutoff wall in the highly permeable baked shale strata based on recent readings of piezometer 638-C has not been addressed. Therefore, the instrumentation program is considered inadequate at this dam.

5.3.4 Units 3 & 4 EHP Saddle Dam

While the number of instruments on the saddle dam appears to be adequate, the locations of instruments on the Saddle Dam and data for the inclinometers were not provided and a full evaluation of the data could not be performed. Two piezometers on the Saddle Dam (SD-00-P1 and SD-00-P2) are measuring water levels consistent with levels in the adjacent cell "G", which indicates little head loss in this area of the dam. The conditions contributing to these high water level measurements should be further evaluated.

6.0 Field Assessment

6.1 General

Site visits to assess the condition of the Units 1 & 2 Bottom Ash Ponds, Pond "A", and STEP, and the Units 3 & 4 EHP at the Colstrip Power Plant were performed on June 2 and 3, 2009 by Stephen G. Brown, P.E., and Mary C. Nodine, P.E., of GEI. Joe Byron of the Environmental Protection Agency, Gordon Criswell and Mike Holzwarth of PPL Montana and Ray Womack, P.E. of Womack Associates (Geotechnical consultant for PPL Montana) assisted in the assessment. Also present was Iver Johnson of the Montana Department of Environmental Quality.

The weather during the site visits was generally overcast with occasional light rain, with the temperatures around 50-60 degrees Fahrenheit. The ground surface was dry on the first day of the inspections (June 2). Rain occurred overnight prior to the second day (June 3) causing the ground surface to be moist.

Field observations are organized as follows:

- Units 1 & 2 Bottom Ash Ponds – west, north and east embankments
- Units 1 & 2 Pond "A" – west embankment
- Units 1 & 2 STEP Dam
- Units 3 & 4 EHP
    - Main Dam
    - Saddle Dam

A checklist is provided in Appendix B and photographs are provided in Appendix C. Sections 6.2 through 6.5 describe observations made during the assessment relative to key project features. Section 6.6 presents specific observations.

6.2 Units 1 & 2 Bottom Ash Ponds

Field assessment of the Units 1 & 2 Bottom Ash Ponds included walking the embankment crest, upstream slope and downstream slope. We saw no obvious signs of settlement or displacement, but one instance of seepage that should be remedied in order to improve the safety of the impoundment. General photos of the Units 1 & 2 Bottom Ash Ponds are shown in Photos 1 (west cell) and 2 (east cell).

6.2.1 Embankment Crest

The embankment crest appeared to be in good condition. No signs of cracking or settlement were observed during the assessment. No vegetation was present on the dam crest. (Photos 3 and 4).

6.2.2 Upstream Slope

The upstream slope of the bottom ash pond embankment is protected from erosion by an RFP liner (west cell – Photo 5) and a clay liner (east cell – Photo 6) and appeared to be in good condition. A concern with regard to the upstream slope was a 24-inch HDPE pipe that protrudes from the interior southwest corner of the west cell of the bottom ash ponds (Photo 7). This pipe serves as a carrier pipe for two smaller 4-inch discharge pipes. The carrier pipe terminates in the interior of the embankment and provides a direct seepage path to the interior of the dam should the pond water level rise above the invert of the pipe. Measures should be taken to seal off the carrier pipe. PPL Montana has indicated the carrier pipe may not be needed for much longer and can be modified or removed.

6.2.3 Downstream Slope

The downstream slope of the embankment is well-vegetated with grass, which provides some erosion protection (Photo 8), with the exception of the west side which is located in a coal storage area. No signs of major instability were observed along the downstream slope, though some oversteepened areas and rodent holes were observed along the toe on the west side of the embankment (Photos 9 and 10). The oversteepened toe appears to be caused by a cut made to establish a valley drain pipe easement adjacent to the toe of the slope. In addition, numerous elongated sinkholes (up to 1 foot wide, 2 feet long and about 6 inches deep) were observed in this area (Photo 11). PPL Montana personnel indicated the sinkholes were associated with the valley drain pipe alignment at the toe that was placed about 5 feet deep. The pipe was placed in the winter and backfilled in freezing temperatures, suggesting that the sinkholes likely occurred because of volume changes in the thawing backfill material. There is an out-of-service steel manhole associated with a cooling water pipe present at the northwest corner of the downstream toe (Photo 12). The manhole is on the order of 20 feet deep and presents a potential seepage pathway.

Evidence of seepage (standing water with vegetation) was observed near the northeast corner of the east cell of the Bottom Ash Ponds (Photo 13). The ponded water was at the downstream toe of the east embankment and has been active for a long period based on the locally dense stand of grass. A box culvert that penetrates the embankment near the crest is the likely seepage pathway. The water level of the east cell was observed to be at the invert of the box culvert. The east cell has a clay lining. The box culvert enables discharge pipes to exit the east cell. These pipes are no longer in service and PPL Montana indicated the box culvert can be removed.

6.2.4 Water Surface Elevations and Reservoir Discharge

Surveyed water surface elevations were not available for the Units 1 & 2 Bottom Ash Ponds. The water surface was on the order of 4 feet below the embankment crest at the time of the site visit. No discharge was observed from the bottom ash ponds.

6.3 Units 1 & 2 Pond "A"

Field assessment of the Units 1 & 2 Pond "A" embankment included walking the embankment crest, upstream slope and downstream slope. We saw no obvious signs of settlement, displacement or adverse seepage that would directly affect the safety of the impoundment. A general photo of Pond "A" is shown in Photo 14.

6.3.1 Dam Crest

The embankment crest appeared to be in good condition. No signs of cracking of settlement were observed during the assessment. No vegetation was observed on the dam crest (Photo 15).

6.3.2 Upstream Slope

The upstream slope of the embankment is protected by the clay pond liner and appeared to be in satisfactory condition. Some vegetation was observed along the inside slope, but there were no signs of instability (Photo 16).

6.3.3 Downstream Slope

The downstream slope of the embankment is well-vegetated, which provides some erosion protection. No signs of major instability were observed along the downstream slope, though some oversteepened areas, rodent holes and sinkholes associated with the buried valley drain pipe were observed along the toe similar to those described for the Bottom Ash Ponds in Section 6.2.3 (Photo 17).

6.3.4 Water Surface Elevations and Reservoir Discharge

The water surface in Pond "A" was surveyed at El. 3,257.52 in May 2009, which is about 6.5 feet below the crest of the surrounding embankment (El. 3,264). No discharge was observed from Pond "A".

6.4 Units 1 & 2 STEP Dam

Field assessment of the Units 1 & 2 STEP Dam included walking the embankment crest, upstream slope and downstream slope and observing the emergency spillway. We saw no obvious signs of settlement, displacement or seepage that would directly affect the safety of the dam.

6.4.1 Embankment Crest

The embankment crest appeared to be in good condition. No signs of cracking or settlement were observed during the assessment. The crest does not have surfacing material for the traffic and has minimal vegetation (Photo 19). One concern is that the crest appears to be one or two feet lower than El. 3,278 at the right abutment, providing a possible path for water passage at an elevation lower than desired. The low area occurs at the right abutment/dam contact and appears to be associated with an earth cut for an access road.

6.4.2 Upstream Slope

The upstream slope of the dam is generally protected from erosion by an HDPE lining, (Photos 20 and 21), with the exception of the portion of the dam near the right abutment near Cell "D" which is not currently impounding water and is vegetated (Photo 18). The upstream abutment generally appeared to be in good condition. Some moderate erosion rills were observed on the upstream face near the right abutment where surface water collecting on the dam crest flows into the unused Cell "D" (Photo 22).

6.4.3 Downstream Slope

The downstream slope of the embankment is well-vegetated, which provides some erosion protection (Photos 23-24). No signs of major instability were observed along the downstream slope. Some erosion rills caused by surface water were observed in the groin near the right abutment (Photo 25). Stormwater flows across the downstream area near the right side of the dam toe due to runoff from a contributing drainage area located southeast of the dam.

6.4.4 Emergency Spillway

The emergency spillway beyond the left abutment of the dam appeared to be in good condition, with no visible deterioration (Photo 26). No pond discharges have ever flowed through the spillway.

6.4.5 Water Surface Elevations and Reservoir Discharge

Water surface elevations in the various STEP pond cells ranged from El. 3,256.5 to El. 3,264.1 in May 2009, or about 6 to 13.5 feet below the dam crest. There is no outlet structure or conduit and, consequently, no discharge was observed from the STEP pond.

6.5 Units 3 & 4 EHP Pond - Main Dam

Field assessment of the Main Dam at the Units 3 & 4 EHP included walking the embankment crest, upstream slope and downstream slope. We saw no obvious signs of settlement, displacement or seepage that would directly affect the safety of the Main Dam.

6.5.1 Embankment Crest

The embankment crest appeared to be in good condition. No signs of cracking or settlement were observed during the assessment. Because the dam will be raised in the future, the crest is currently much wider than its proposed 20 feet. The crest is vegetated with grass and has a dirt road near the centerline of the dam (Photo 27). The dam crest appears to have a length of fill located in a small saddle about 500 feet to the left of the left abutment (Photo 28). This fill should also be considered part of the dam until conditions are documented that indicate it does not serve as part of the dam structure.

6.5.2 Upstream Slope

The upstream slope of the Main Dam is protected by soil cement and appeared to be generally in satisfactory condition (Photo 29 and 30). Some seepage and erosion was observed at the left abutment groin on the upstream slope. The seepage was located more than 10 feet above the reservoir water level. Ray Womack of Womack Consulting indicated that the seepage originates from perched groundwater within the dam abutment and the adjacent divider dike due to the recent rain (Photo 31). This seepage location was also acknowledged in Womack's 2009 report. The report indicates that the seepage originates due to surface water collecting in the baked shale and has no effect on the stability of the dam.

6.5.3 Downstream Slope

The downstream slope of the embankment is well-vegetated, which provides some erosion protection (Photos 32 and 33). No signs of major instability were observed along the downstream slope. Some animal burrows, including one excavated into the drainage sand at the right downstream groin, and minor erosion rills caused by surface water were observed (Photos 34 and 35). Seepage has been observed in the natural ground a short distance downstream of the Main Dam since 2000 (Womack 2009) and studies have shown the flow originates from seepage through the sandstone in the left abutment of the dam. This seep has been referred to as the “552 Seep” in PPL’s documents.

6.5.4 Water Surface Elevations and Reservoir Discharge

Water surface elevations in the various EHP cells ranged from El. 3,234.5 to El. 3,287.1 in May 2009 (the higher elevations are within cells completely surrounded by dikes with crest elevations higher than those of the dams). There is no outlet structure or conduit and, consequently, no discharge was observed from the EHP.

6.6 Units 3 & 4 EHP - Saddle Dam

Field assessment of the Units 3 & 4 EHP Saddle Dam included walking the embankment crest, upstream slope and downstream slope. Significant settlement, displacement, and seepage issues were discussed and observed that would directly affect the safety of the dam for storage of water at its design normal water surface. These issues are not a concern with the current restricted operating level of El. 3,237, which is 25 feet below the dam crest.

6.6.1 Embankment Crest

The embankment crest appeared to be in fair condition. Because the dam will be raised in the future, the crest is currently wider than its proposed 20 feet. There is a dirt road along the downstream side of the crest, (Photo 36) while the upstream side is vegetated with a thick stand of sage brush and grass (Photo 37). PPL Montana personnel pointed out healed cracks in areas where cracking and settlement occurred associated with the 1999 seepage event (Photos 38 and 39). Cracks up to about 1 foot wide and several feet deep were originally observed during the inspection by Maxim Technologies in 1999 (Maxim, 2005) and have since been repaired. No new damage was observed beyond that documented in the past.

6.6.2 Upstream Slope

The upstream slope of the dam is protected by soil cement and appeared to be in good condition (Photo 40). Minor vegetation was becoming established on the soil cement in some areas (Photo 41).

6.6.3 Downstream Slope

The downstream slope of the embankment is well-vegetated, which provides some erosion protection (Photos 42 and 43). Several issues were noted during the field assessment of the downstream slope. Near the center of the dam at the downstream toe was an open test pit (Photo 44) that was excavated about 10 years ago to observe the toe drain during the 1999 seepage event. The drain sand and a broken toe drain pipe were visible in the test pit

(Photo 45). PPL operates the adjacent cell "G" with a restricted water level below El. 3,237 to prevent recurrence of the seepage issue. Some minor surface erosion was also observed along the downstream slope (Photo 46).

Seepage occurred in 1999, 2004 and 2005 at separate locations around the EHP and the seepage flows surfaced 100 to several hundred yards downstream of the dam. After the 1999 incident, the water level behind the Saddle Dam was lowered, and the seepage ceased. The area where the 1999 seepage discharge occurred was observed (Photo 47). The 2004 and 2005 seepage events occurred to the south and west of the EHP through fractured rock. The south and west sides of the EHP are contained only by the concrete cutoff walls – there is no dam in these areas. The seepage occurred though fractured rock and measures were implemented by PPL to eliminate the source of water in the adjacent cells by first removing the water and then constructing a synthetic membrane lining in the cells or by filling the cells with paste.

6.6.4 Water Surface Elevations and Reservoir Discharge

See the discussion in Section 6.5.4 for EHP Main Dam.

6.7 Field Inspection Observations

6.7.1 Settlement

Settlement cracks have been observed in the crest of the Units 3 & 4 EHP Saddle Dam in conjunction with the 1999 seepage event. The cracks were aligned along the upstream side of the concrete cutoff wall and indicate differential settlement associated with the seepage flows at the contact between the dam embankment and concrete cutoff wall. Internal erosion of embankment material likely occurred due to the seepage flow around the cutoff wall transporting soil particles into the highly permeable baked shale strata. The cracks have healed as a result of precipitation and in-filling and no fresh cracks were observed during the June 2009 assessment. No evidence of settlement was observed in other dams or embankments.

6.7.2 Movement

There was no evidence observed during the inspection to indicate differential movement of project structures, except as noted for the Saddle Dam in Section 6.7.1.

6.7.3 Erosion

There was no significant erosion of the dams or abutments noted during the assessment. Some oversteepening at the toe of the embankment of the on-site ponds was observed, and minor erosion caused by surface water was observed in several locations at the dams at the Units 1 & 2 STEP and the Units 3 & 4 EHP.

6.7.4 Seepage

The only location where uncontrolled seepage was observed during the assessments was on the east side of the Units 1 & 2 Bottom Ash Pond, at the downstream toe of the east embankment. A small pool of standing water with well established grass was visible in this location (Photo 13). The seepage appears to originate from an out-of-service box culvert that penetrates the east embankment near the crest. The box culvert no longer serves a useful purpose and should be removed and the embankment backfilled with engineered fill.

PPL Montana personnel indicated that the Units 3 & 4 Saddle Dam had seepage problems at various locations where springs formed in the foundation rock several hundred feet downstream of the EHP in 1999, 2004 and 2005. Seepage at the 1999 location was not observed during this assessment and the cell “G” reservoir was below the restriction limit El. 3,237. The 2004 and 2005 seepage events occurred through natural fractured bedrock and the constructed concrete cutoff wall have been controlled by operational changes. Because the 2004 and 2005 seepage events did not involve dam structures, we did not observe these sites during our visit. See section 6.7.1 for additional discussion of issues associated with the 1999 seepage event.

6.7.5 Leakage

We did not observe water leaking from any of the project structures.

6.7.6 Cracking

There were no new cracks observed in the upstream or downstream slopes or the crests of the dams. Healed cracks in the crest of the Units 3 & 4 EHP Saddle Dam were observed.

6.7.7 Deterioration

No significant deterioration of project structures was observed with exception of the EHP Saddle Dam, which was damaged by the 1999 seepage event and has not been repaired.

6.7.8 Geologic Conditions

The geology of the project features is as described in the prior reports. There have been no studies or events (landslide, earthquake, etc.) that would result in changes to the description of local geologic conditions.

6.7.9 Foundation Deterioration

No signs of foundation deterioration were observed with exception of the EHP Saddle Dam, which was damaged by the 1999 seepage event and has not been repaired.

6.7.10 Condition of Spillway and Outlet Works

The emergency spillway at the Units 1 & 2 STEP Dam appeared to be in good condition. No flows or releases have occurred through the spillway.

6.7.11 Reservoir Rim Stability

The reservoir rims visible from the dam crests did not show any evidence of landslides or shoreline instability that would threaten the safety of the dams.

6.7.12 Uplift Pressures on Structures, Foundations, and Abutments

No evidence of uplift pressure issues was observed with exception of the EHP Main Dam, which has high water levels in the dam abutment rock. These high water levels contribute to seepage through the sandstone that emerges downstream of the dam (the “552 Seep”). The high water levels are monitored and are controlled by pumping wells in the abutments to reduce the potential seepage flow.

6.7.13 Other Significant Conditions

None.

7.0 Spillway Adequacy

7.1 Floods of Record

Floods of record have not been evaluated for the ponds at the Colstrip facility.

7.2 Inflow Design Floods

The Units 1 & 2 STEP and the Units 3 & 4 EHP impoundments were designed based on U.S. Army Corps of Engineers (USACE) guidelines that developed a 24-hour probable maximum precipitation (PMP) of 24 inches. Current hydrometeorological guidelines are based on the 72-hour PMP.

Original hydrologic studies for the Units 1 & 2 Bottom Ash Ponds and the "A" Pond are not available. The ponds are designed with 4 feet of freeboard (Portage, 2005) and are not expected to accumulate any significant run-on since they are surrounded by above-grade dikes on all sides. Therefore, the ponds can safely impound the 24-hour PMP with two remaining feet of freeboard, which we expect would be sufficient to store the difference between the 24-hour and the 72-hour PMP. The on-site ponds are therefore considered adequate to store the inflow design floods.

The Units 1 & 2 STEP and the Units 3 & 4 EHP were checked for compliance with the 72-hour PMP (Maxim, 2005). The Units 1 & 2 STEP Dam has been classified as a high hazard dam (Maxim, 2005). The USACE Guidelines for dams requires the spillway on such dams be able to pass the full PMF. The STEP was designed to contain the 100-year flood followed by the PMF associated with the 24-hour PMP, for a total flood volume of 872 acre-feet (Bechtel, 1979). The 2005 Phase I inspection report (Maxim, 2005) indicates that the STEP was independently evaluated using the 72-hour PMP in 1988. The pond was found to be able to hold most of the PMF in this case, while the spillway would safely pass the remaining 501 acre-feet with a maximum discharge of 111 cubic feet per second (cfs) at a depth of 0.8 feet. We reviewed these evaluations and compared them with current hydrometeorological reports, and found the existing STEP Dams and spillway to be able to safely pass the full PMF.

The Units 3 & 4 EHP Dams were classified as Low Hazard dams (Maxim, 2005). However, based on the potential for significant economic/environmental damage and flooding of residences and farmland following a breach, the EHP should likely be classified as Significant Hazard and possibly High Hazard. Conservatively assuming that the dams are classified as high hazard, they will be required to pass or safely store the PMF. The EHP was designed to contain the 100-year flood followed by the PMF associated with the 24-hour

PMP, for a total flood volume of 1186 acre-feet (Bechtel, 1982) when it is completed to full crest height El. 3,290. The 2005 inspection report (Maxim, 2005) indicates that the ponds were independently evaluated using the 72-hour PMP in 1988. The pond was found to be able to hold most of the PMF in this case, with the (future) spillway discharging a maximum of 29 cfs at a depth of 0.4 feet. We reviewed these evaluations and compared them with current hydrometeorological reports, and found the planned EHP dams and spillway to be able to safely pass the PMF based on the full height crest El. 3,290.

However, at the time of our assessment, the EHP dams had crests at El. 3,262, and construction to their final height, including construction of the emergency spillway, is planned for 2011. The "G" cell that is impounded behind the Saddle Dam currently has a water level at about El. 3,234. The Old Clearwell cell that is impounded behind the Main Dam had a water level at about El. 3,234. Cell "A" cell, which is located upstream of the Main Dam, has been filled with solids since 2005 and there is no impounded water associated with Cell "A". Cell "G" and the Old Clearwell currently have more than 24 feet of freeboard, which is sufficient to store significantly more than the 24-hour or 72-hour PMP. Cell "A" has 3 feet of freeboard and can store the 24-hour PMP, but may be close to zero freeboard under 72-hour PMP conditions if excess water is not distributed to the adjacent Old Clearwell. In general, the Main and Saddle Dams are considered adequate to store the design floods at their current height, but the capacity of Cell "A" to store the 72-hour PMP should be evaluated. Given the complications associated with the 1999 seepage through the Saddle Dam, water levels should be maintained at, or below, the restricted level of El. 3,237 to the extent possible until remedial measures are implemented. PPL has begun filling Cell "G" with paste as a mitigation measure for the Saddle Dam.

7.2.1 Determination of the PMF

The PMF based on the 24-hour PMP is 24 inches per hour as determined in the design reports for the STEP and EHP Dams. The dams have been previously checked and found adequate to safely pass the 72-hour PMP.

7.2.2 Freeboard Adequacy

Freeboard is adequate at all facilities.

7.2.3 Dam Break Analysis

Consistent with PPL Montana's classification of the Units 1 & 2 Bottom Ash Pond and Pond "A" as Significant Hazard and the potential concern cited for loss of life, dam break analyses and inundation mapping has been performed for these ponds. According to PPL, the dam break analysis was completed in June 2009, but has not yet been formally submitted to the state regulatory agency.

Dam break analyses and inundation maps are available for the Units 1 & 2 STEP Dam and the Units 3 & 4 EHP Dams (Maxim, 2005 and 2008). The inundation map for the STEP dam revealed that a breach of this dam would cause flooding of nearby residences, businesses, a highway and a railroad. The inundation mapping for the EHP dams shows that the flood wave would travel many miles down Cow Creek and flooding isolated farm buildings and residences. The inundation maps were reviewed for this assessment and are considered adequate. However, the EHP inundation map evaluation (Maxim, 2008) did not focus on the potential for significant economic and, particularly, environmental damage associated with a breach. Our brief review indicated that the potential economic/environmental damage could be significant and that the EHP should be classified as Significant Hazard at a minimum. The flooding of habitable structures and residences downstream should also be further evaluated to determine the potential for loss of life under Federal guidelines and the associated hazard classification.

7.3 Spillway Rating Curves

Spillway rating curves for the STEP Dam emergency spillway were not provided. The EHP does not have an emergency spillway.

7.4 Evaluation

Upon review of the design floods developed by Bechtel and re-evaluated by Maxim, the emergency spillway discharge capacity at the STEP Dam appears to be adequate to safely pass the regulatory design floods based on the hazard classification for the dam. The EHP water levels should continue to be restricted unless remedial measures are taken to repair the Saddle Dam or the Saddle Dam is used for storing paste exclusively and the documentation is modified to reflect this use. Design PMP and inflow flood information for the small Units 1 & 2 Bottom Ash and "A" ponds is not available, but based on dam crest elevations and water storage elevations these ponds appear to have sufficient freeboard to store the PMF for this region.

8.0 Structural Stability

8.1 Visual Observations

No visible signs of instability were evident associated with the any of the dams or embankments during the June 2009 site assessments.

8.2 Discussion of Stability Analysis

8.2.1 Units 1 & 2 Bottom Ash Ponds and Pond "A"

Slope stability analyses and inspection reports were not available for the on-site ponds. We performed preliminary stability analyses on these embankments using the limit equilibrium computer program SLOPE/W. These stability analyses were performed with current and relevant geometry information provided to us.

We based the embankment geometry for the slope stability analyses on the cross sections shown in Figures 6 and 7. We analyzed Sections A and B as representative of the west embankment, which impounds the Units 1 & 2 Bottom Ash Ponds and Pond "A". Soil parameters were assumed to be the same as those used for design of the STEP Dam (Bechtel, 1979). Bedrock depth was estimated from the Portage, 2005 report on design of the "B" Bottom Ash Pond and was assumed to be at El. 3,217. Piezometric surfaces were estimated using conservative assumptions. The soil material properties adapted from the STEP design are listed in Table 3.

Table 3: Material Properties used for Slope Stability Analyses of Units 1 & 2 Bottom Ash and "A" Pond Embankments

Material	Drained Friction Angle, ϕ' (degrees)	Drained Cohesion, c' (psf)	Undrained Friction Angle, ϕ (degrees)	Undrained Cohesion, c (psf)	Unit Weight
Random Fill (Same as Shell for STEP Dam)	33	0	22.5	750	120
Core	33.5	0	13	1,000	120
Foundation	32	0	17.5	700	120
Bedrock	0	4,000	0	4,000	130

Graphic results of stability analyses are shown in Appendix E. Factors of safety were found to meet FERC requirements, and are discussed and summarized below in Section 8.3.

8.2.2 Units 1 & 2 STEP Dam

The results of slope stability analyses performed for the design of the STEP dam are reported in the Second Stage Evaporation Pond Design Report (Bechtel, 1979). The analyses were performed using the Simplified Bishop Method of Slices with the computer program SLOPE developed at MIT. Load cases analyzed included Normal Pool (El. 3,270, referred to as "Maximum Pool" in the design report), Normal Pool with Seismic Loading (0.05g) and End of Construction (which is no longer of concern since the dam has been in place for more than twenty years). In the 1979 design, the rapid drawdown condition was not modeled based on the stated reasoning that there is no low-level outlet to rapidly drain the reservoir. Both the upstream and downstream slopes were analyzed. These analyses were checked independently in a 1988 inspection (Chen-Northern, 1988), and a rapid drawdown analysis was also performed at this time. Factors of safety were found to meet or exceed Federal Energy Regulatory Commission (FERC) requirements. The material properties used in the 1979 stability modeling were based on laboratory testing of site-specific materials with some conservative assumptions. Where laboratory test data were scarce, data from the First Stage Evaporation Pond dam design laboratory tests were included in parameter development. The analyses performed in the 1988 inspection report used the average of drained and undrained strength parameters for both steady seepage and earthquake load cases, resulting in slightly higher factors of safety than the 1979 analyses. Undrained strengths were assumed for the 1988 rapid drawdown analysis. Information on the phreatic surface assumed within the dam was not available in the 1979 design report or in the 1988 inspection report.

The stability analyses included in the 1979 design report and the 1988 inspection report were reviewed. The loading conditions used in the previous analyses have not changed and these analyses are considered adequate.

8.2.3 Units 3 & 4 Main Dam

The results of slope stability analyses performed for the design of the dam are reported in the Effluent Holding Pond Design Report (Bechtel, 1982). The analyses were performed using the Simplified Bishop Method of Slices with the computer program SLOPE developed at MIT for the final configuration of the Main Dam with crest at El. 3,290. Load cases analyzed included Normal Pool (El. 3,280, referred to as "Maximum Pool" in the design report), Normal Pool with Seismic Loading (0.05g) and End of Construction (which is no longer of concern since the dam has been in place for more than twenty years). In the 1982 design, the rapid drawdown condition was not modeled based on that stated reasoning that there is no low-level outlet from which the pond can be rapidly drained. Both the upstream and downstream slopes were analyzed. Information on the phreatic surface assumed within the dam was not available in the 1983 report. The 2005 inspection report (Maxim, 2005) indicates that these analyses were checked independently in 1988 and factors of safety were found to meet or exceed the minimum factors of safety required by FERC. The 1988 inspection report was not made available to GEI.

The material properties used in the stability modeling were based on laboratory testing of site-specific materials with some conservative assumptions. Design strength parameters for the shell material were based on similar materials used for the Units 1 & 2 STEP Dam, located four miles away. Chen and Associates performed a geotechnical exploration of the shell material in 1989 and confirmed that the shell material was at least as strong as was assumed in the design report.

Several boreholes were drilled and completed as observation wells or piezometers in the dam and abutments in 2001. Stability analyses were subsequently performed by Hydrometrics to evaluate the stability of the dam in its current configuration with crest El. 3,262 based on the pore pressure information from one piezometer in the dam core and also for an assumed phreatic surface to model a case where the internal drains malfunctioned and excess pore water pressures built up beneath the embankment. Analyses were performed for two cross sections assuming both circular and block failure surfaces. For the case based on the piezometer data, the factors of safety were found to meet or exceed the minimum factors of safety required by FERC in the 2001 study. For the case based on the assumed excess water pressures, the factors of safety were found to be as low as 1.23 and did not meet the minimum factors of safety of 1.5 required by FERC. The 2001 study considered this analysis to be very conservative. In 2009, piezometer data from 2007 was used to re-run the slope stability analyses with the dam crest at El. 3,262, and a factor of safety of 1.5 was calculated, which meets the minimum factor of safety required by the FERC. The 2009 report concluded that the chimney drain was functioning as designed (Womack, 2009).

The stability analyses discussed above were reviewed for this assessment. The 2001 and 2009 analyses indicate conditions are present for a potentially significant seepage issue where seepage pressures in the sandstone can bypass the cutoff wall and act on the downstream embankment shell. This potential is illustrated by the available data that show the pressure head in the abutment sandstone is about 5 feet higher than in the adjacent dam core. The 2001 analysis attempts to model higher pore pressures in the dam core and downstream shell; however the basis for the model is not well established because there is a lack of pore pressure data at those locations. There is only one piezometer installed in the dam and two in each abutment, and the model does not take into account the high water levels measured in the baked shale strata in the right abutment downstream of the cutoff wall, which could indicate seepage through the baked shale, and a potentially more severe condition than the seepage through the sandstone discussed in section 5.3.3. The analysis of the potential seepage pressure case does not appear to be complete and the instrument data needed to perform the analysis with increased certainty is not available.

8.2.4 Units 3 & 4 EHP Saddle Dam

The results of slope stability analyses performed for the design of the dam are reported in the Bechtel 1983 "Effluent Holding Pond Design Report." The analyses were performed using the Simplified Bishop Method of Slices with the computer program SLOPE developed at MIT for the dam in its final configuration with crest El. 3,290. The load cases analyzed are the same as those discussed above for the Main Dam. Both the upstream and downstream slopes were analyzed and the 2005 inspection report (Maxim, 2005) indicates that these analyses were checked independently in 1988 and factors of safety were found to meet or exceed the minimum factors of safety required by FERC. The 1988 EHP inspection report was not reviewed by GEI.

The material properties used in the stability modeling were based on laboratory testing of site-specific materials with some conservative assumptions. Where laboratory test data were scarce, data from the First Stage Evaporation Pond dam design laboratory tests were included in parameter development. Information on the phreatic surface assumed within the dam was not available in the 1979 report. All calculated factors of safety were higher than those required by FERC.

The stability analyses included in the 1979 report were reviewed. The loading conditions used in the previous analyses have not changed and these analyses are considered adequate for the dam at its final height.

8.3 Factors of Safety

8.3.1 Units 1 & 2 Bottom Ash and Pond "A" Dams

Our check analyses for the Bottom Ash and "A" Pond embankments, which were based on assumed soil material parameters adapted from the STEP design, resulted in calculated factors of safety of 1.5 for the steady seepage load case, 1.2 for the pseudostatic earthquake load case and 1.1 to 1.4 for the rapid drawdown load case. We used drained strengths for the pseudostatic earthquake analysis because they provide conservative strength values for small embankments. The End of Construction load case was not analyzed because the embankment has been in place for more than 30 years and the pore pressures would have equilibrated. The factor of safety of 1.1 for rapid drawdown at Section B of Pond "A" is somewhat below the FERC minimum required factor of safety of 1.2, however, the full-reservoir depth instantaneous drawdown is considered a conservative analysis for this pond, which does not have a low level outlet to facilitate drawdown. Factors of safety for the remaining load cases meet or exceed the minimum criteria accepted by FERC. The calculated factors of safety are presented with the FERC minimum required factors of safety in Table 4.

Though our preliminary analyses indicate that the on-site embankments are satisfactory, we recommend performing additional analyses using site-specific strength data for the embankment soil and any appropriate adjustments to the phreatic surface to verify the stability condition and identify if remedial measures are warranted.

8.3.2 Units 1 & 2 STEP Dam

We reviewed the calculated factors of safety for the embankment contained in the Bechtel 1979 draft report and in the Chen-Northern 1988 inspection report. These reports indicate factors of safety ranging from 1.6 to 2.1 for the steady seepage load case, 1.3 to 1.7 for the pseudostatic earthquake load case, and 1.2 for the rapid drawdown load case. These factors of safety exceed the minimum factors of safety required by FERC as presented in Table 4.

8.3.3 Units 3 & 4 EHP Main Dam

We reviewed the factors of safety for the embankment contained in the various reports completed for the EHP Main Dam. The original design report (Bechtel, 1982) indicates that factors of safety range from 1.8 to 2.0 for steady seepage and from 1.3 to 1.7 for pseudostatic earthquake loading for the dam at its final height of El. 3,290. In a 2001 stability analysis, which used pore water pressure information from a recently-installed piezometer, steady seepage factors of safety for the dam at its current crest El. 3,262 ranged from 1.6 to 1.9 for existing pore water pressure conditions and from 1.2 to 1.6 for assumed higher pore water pressures downstream of the core to model a potential malfunction of the internal drains (Hydrometrics, 2001). The 2009 Stability Analysis Review Update for the dam at its current crest El. 3,262 indicates factors of safety of 1.5 using pore water pressure conditions as measured in the piezometer in 2007 (Womack & Associates, 2009). These factors of safety exceed the minimum factors of safety required by FERC as presented in Table 4. However, as discussed below, the level of conservatism realized by the 2001 and 2009 analyses is not certain and would benefit from additional pore pressure measurements within the downstream shell and core of the dam and abutment sandstone as well as consideration of recent readings in the piezometer located in the right abutment baked shale.

Though not stated outright, the 2001 and 2009 stability analyses appear to be studies of the potential for high pore pressures to be introduced into the dam embankment from seepage in the sandstone strata that is present in the abutments. In the Station 19+00 cross section shown in Figure 2 from the report by Hydrometrics (2001), the sandstone stratum extends above the bottom of the dam core, and extends through the abutments of the dam beyond the end of the core. The sandstone is known to carry seepage from the reservoir and is known to have fractured zones with higher permeability as discussed in the study of the “552 seep” downstream. The sandstone could enable high seepage pressures from the reservoir to come into contact with the downstream embankment, which would worsen existing seepage conditions and potentially contribute to instability of the dam.

The measured piezometer water levels in the sandstone are 5 feet higher than those measured in piezometer 636P, which is located near the base of the core and just downstream of the cutoff wall. The potential for high pore pressures to exist in the sandstone and be introduced into the dam embankment downstream of the core and cutoff wall is a significant dam safety concern. The 2001 and 2009 analyses are based on information from only one functioning piezometer in the dam core (636P), and do not include sufficient information about pore pressure conditions elsewhere in the dam, particularly in the downstream shell. The initial data from piezometer 637P indicates water pressures may be 10 feet higher than recorded in 636P. As a result, the level of conservatism presented in the 2001 and 2009 analyses is not certain. We recommend additional analysis include seepage modeling of the dam and abutments, consideration of recent readings from the piezometer in the baked shale, in combination with additional pore pressure measurements obtained within the downstream shell and core of the dam and within the abutment sandstone and baked shale.

8.3.4 Units 3 & 4 EHP Saddle Dam

We reviewed the computed factors of safety for the embankment contained in the Bechtel 1982 draft report. This report show factors of safety ranging from 1.7 to 1.8 for the steady seepage load case and from 1.4 to 1.5 for the pseudostatic earthquake load case for the dam at its final height with crest El. 3,290. These factors of safety exceed the minimum factors of safety required by FERC as presented in Table 4.

Stability analyses performed for the Saddle Dam appear to adequately address critical dam sections with exception that the compromised seepage control measures have not been addressed. The analyses presented in the original design report all meet the minimum required factor of safety criteria according to FERC guidance. However, due to the observation of seepage downstream of the toe of the saddle dam and the lowering of water levels that was required to stop the seepage, we recommend that stability be re-evaluated incorporating any new geotechnical or hydrologic information or remedial measures. In particular, the revised analyses should include conservative assumptions regarding the capacity of seepage control measures if the seepage control features have not been satisfactorily repaired. If the dam will only be used to impound paste for the rest of its life, an appropriate model should be used to reflect the potential for reduced seepage.

8.3.5 Summary

We compare the reported calculated factors of safety for the STEP and EHP dams to minimum required factors of safety in accordance with FERC guidelines in Table 4. Values shown are the minimum factor of safety found in any of the analyses performed. The dams at the Colstrip facility are not regulated under the Montana Dam Safety Act, so those guidelines are not included. The Montana Dam Safety guidelines refer to the USACE guidelines, which are the same as, or less conservative than, the FERC guidelines shown in Table 4.

Table 4: Stability Factors of Safety for Colstrip Facility Dams and Guidance Values

Loading Condition	Min. Calculated FOS, Bottom Ash and "A" Pond (GEI)	Min. Calculated FOS, STEP Dam (Crest El. 3290)	Min. Calculated FOS, EHP Main Dam (Crest El. 3290)	Min. Calculated FOS, EHP Main Dam (Crest El. 3262)	Min. Calculated FOS, EHP Saddle Dam	Min. Required FOS (FERC)
End of Construction	NA	1.8	2.0	Not Analyzed	1.8	1.3
Full Reservoir – Steady Seepage	1.5	1.6	1.8	1.5	1.7	1.5
Full Reservoir – SS with Earthquake (0.05g)	1.2	1.3	1.3	Not Analyzed	1.4	1.0
Rapid Drawdown	1.1 (Pond "A")	1.2	Not Analyzed	Not Analyzed	Not Analyzed	1.2

As indicated in Table 4, the calculated factors of safety for static and pseudostatic earthquake load cases meet or exceed the minimum required FERC guidelines except for Pond "A" rapid drawdown, which is somewhat below the guidance value but is considered to be a conservative analysis that does not indicate impending instability and that should be revisited for documentation purposes using site-specific soil material strength data.. Also, the original analyses for EHP Main Dam and Saddle Dams were for the crest at El. 3,290, which is 28 feet higher than the current crest.

The potential for high pore pressures to exist in the sandstone of the EHP Main Dam and be introduced into the dam embankment downstream of the core and cutoff wall is a significant dam safety concern based on the available instrument data. The 2001 and 2009 stability analyses do not include sufficient information about pore pressure conditions elsewhere in the dam, particularly in the downstream shell and, as a result, may not be sufficiently conservative. We recommend performing additional analyses that includes seepage modeling of the dam and abutments, consideration of recent readings from the piezometer in the right abutment baked shale, obtaining additional pore pressure measurements within the downstream shell and core of the dam and abutment sandstone, and validating the model with measured seepage flow rates collected by the internal drains.

8.4 Seismic Stability - Liquefaction Potential

The liquefaction potential at the various project features was not evaluated in the design studies because saturated granular soils that are potentially liquefiable are not present in the dam embankment and foundation.

9.0 Adequacy of Maintenance and Methods of Operation

9.1 Procedures

There are no written Standard Operating Procedures for the Colstrip impoundments. The operations of the impoundments are largely determined by the water recycle needs of the power plant.

Bottom ash from steam generation Units 1 and 2 is pumped as a slurry to the on-site ponds just south of the plant. Partial settling of particulates occurs in these ponds and the remaining clearwater is returned to the plant. A substantial amount of the bottom ash is reclaimed from the on-site ponds and used for construction of plant facilities including roads and dikes or is sold commercially. The fly ash/FGD is pumped as a slurry to the Units 1 & 2 STEP for final storage. A new paste plant located at the STEP will process the fly ash/FGD slurry beginning in 2010.

The bottom ash from steam generation Units 3 & 4 is transported to the on-site bottom ash ponds to the east of the plant for temporary storage, and then to the Units 3 & 4 EHP for final storage. The fly ash/FGD slurry from Units 3 & 4 is pumped directly to the Units 3 & 4 EHP paste plant, where it is thickened and deposited as paste.

9.2 Maintenance of Dams

Maintenance of the dams and embankments at the Colstrip facility is performed or subcontracted by PPL Montana staff. Inspections are made annually by PPL engineers and approximately every five years by outside consulting engineers.

9.3 Surveillance

PPL Montana staff is responsible for the surveillance of the dams and appurtenant facilities. Monitoring of the dams instrumentation currently occurs monthly. The main power plant is manned 24 hours a day and operators can respond to potential emergency situation at the dams. There are no automatic warning systems for the dams.

10.0 Emergency Action Plan

The Montana State Dam Safety Program requires that all dams classified as “high hazard” have an emergency action plan. It is our understanding that the Units 1 & 2 STEP Dam and the Units 3 & 4 EHP Dams have emergency action plans with inundation maps and are on file at the Colstrip plant. Consistent with PPL Montana’s classification of the Units 1 & 2 Bottom Ash Pond and Pond “A” as Significant Hazard and the potential concern cited for loss of life, dam break analyses and inundation mapping has been performed for these ponds. According to PPL, the dam break analysis was completed in June 2009, but has not yet been formally submitted to the state regulatory agency. The EAPs were not reviewed as part of the assessment.

11.0 Conclusions

11.1 Assessment of Dams

11.1.1 Units 1 & 2 Bottom Ash Pond Embankments

- The 24-inch HDPE pipe protruding from the interior southwest corner of the westernmost cell provides a direct seepage path to the interior of the dam.

- Oversteepened areas and rodent holes were observed along the downstream toe of the west embankment, as well as small sinkholes associated with the buried valley drain pipe alignment along the downstream toe.

- An abandoned manhole at the downstream toe of the northwest corner of the impoundment presents a potential seepage path.

- Evidence of seepage (standing water with vegetation) was observed at the downstream toe of the east cell. A box culvert near the crest of the embankment is the likely seepage pathway. The box culvert is no longer in service.

11.1.2 Units 1 & 2 Pond "A" Embankment

- Oversteepened areas, rodent holes and sinkholes associated with the buried valley drain pipe were observed along the downstream toe of the west embankment similar to those described above for the Bottom Ash Ponds.

11.1.3 Units 1 & 2 STEP Dam

- The crest of the dam is lower than El. 3,278 at the right abutment, providing a possible flow path resulting in concentrated flows at high reservoir elevations.

- Some erosion rills were observed on the upstream slope near the right abutment and on the downstream slope in the groin near the right abutment.

11.1.4 Units 3 & 4 EHP Main Dam

- The small saddle fill located about 500 feet left of the left abutment is not currently considered part of the Main Dam, and may function as part of the Main Dam.

- Several animal burrows, including one that exposed drainage sand in the right groin drain, and minor erosion rills caused by surface water were observed on the downstream face of the dam.

11.1.5 Units 3 & 4 EHP Saddle Dam

- An old test pit remains open at the downstream toe of the saddle dam. Drain sand and a broken toe drain pipe are exposed in the test pit.

- Minor surface erosion was observed on the downstream slope.

- Seepage occurred in 1999 at a location downstream of the dam. After this incident, the water level in cell "G" behind the Saddle Dam was lowered, and the seepage ceased. The water level in cell "G" remains restricted to El. 3,237, but rehabilitation of the Saddle Dam has not been performed. According to PPL, an engineering evaluation of the dam will be performed in 2010 in preparation for the dam raise, which is planned for 2011.

- Seepage events occurred though fractured rock to the south and west of the EHP in 2004 and 2005. The south and west sides of the EHP are contained only by the concrete cutoff walls – there is no dam in these areas. The seepage has been addressed by PPL by eliminating the source of water in the adjacent cells by first removing the water and then constructing a synthetic lining in the cells or by filling the cells with paste.

11.1.6 Stability Analysis (Adequacy of Factors of Safety)

We performed check stability analyses of the Units 1 & 2 Bottom Ash and Pond "A" west embankment using soil strength parameters from the STEP Dam report. Factors of safety were found to meet or exceed minimum FERC requirements, except a rapid drawdown analysis for cross-section B of the west embankment that impounds Pond "A" indicates factors of safety somewhat below the guidance values. The rapid drawdown analysis of this cross-section is considered to be conservative and the calculated factor of safety adequate for this level of check analysis.

The stability analyses that have been performed for the Units 1 & 2 STEP Dam appear to adequately address critical sections in general, and the analyses meet the minimum required factor of safety criteria according to FERC guidance.

Stability analysis of the Units 3 & 4 EHP Main Dam does not fully address the potential for high pore pressures to be introduced downstream of the core by seepage through the sandstone in the abutments, which presents a significant dam safety issue. Analyses performed to date have been based on insufficient data to fully understand the pore pressure conditions within the dam and the effectiveness of the internal drain system. Additional piezometer instruments are needed in the downstream embankment shell and downstream abutments. Additional seepage analyses are needed to model the phreatic surface and relationship to the abutment sandstone, and to take into account recent data from the piezometer in the right abutment baked shale, which was previously dry in 2001 and now indicates several feet depth of water that could represent seepage in the baked shale. Measurements of flow rates collected by the internal drains are needed to verify their function and to calibrate the seepage models.

Stability and seepage should be re-evaluated for the Saddle Dam if there are operating conditions that would require the dam to impound liquid. High water level readings in two Saddle Dam piezometers should be documented and evaluated. The Saddle Dam should continue to be operated with the El. 3,237 reservoir restriction. The rapid drawdown load case has not been analyzed for either the STEP or EHP dams.

11.1.7 Stress Evaluation

Stress evaluation is not applicable to the dams at the Colstrip facility because there are no structural elements or buildings that would warrant a stress evaluation.

11.1.8 Spillway Adequacy

The emergency spillway discharge capacity at the STEP Dam appears to be adequate to safely pass the regulatory design floods based on its High Hazard classification. The EHP does not have an emergency spillway, but appears to have sufficient capacity to store the regulatory design flood even if the dam were classified as High Hazard. Design flood information for the Units 1 & 2 Bottom Ash and Pond “A” is not available, but based on the dam crest elevations and water storage elevations these ponds appear to have sufficient freeboard to store the PMF for this region.

11.2 Adequacy of Instrumentation and Monitoring of Instrumentation

The instrumentation in the dams and embankments is inadequate. There are no piezometers, or movement monuments located within the Units 1 & 2 STEP Dam. The single electric piezometer in the Units 3 & 4 Main Dam and four piezometers in the abutment sandstone and baked shale are inadequate to develop full understanding of the pore pressures within the dam and abutment, which present a potentially significant dam safety issue. There are no piezometers for the Units 1 & 2 Bottom Ash and Pond “A” embankments, particularly the west embankment which impounds the ponds.

11.3 Adequacy of Maintenance and Surveillance

The dams and embankments and the PPL Montana Colstrip facility have satisfactory maintenance and surveillance programs. Significant seepage problems have been observed and remedied in the past. Routine maintenance activities to address surface erosion, rodent burrows, and to backfill/repair excavations (Saddle Dam test pit) should be addressed promptly.

11.4 Hazard Classification

The Units 1 & 2 Bottom Ash Ponds and "A" Pond were classified by PPL as "Significant Hazard" due to the vicinity of residences and Armell's Creek and the potential for loss of life in the event of a breach. EPA hazard classification states that any dam whose "failure or misoperation will probably cause loss of human life" should be classified as a High Hazard dam. We concur that the minimum appropriate classification for these ponds is Significant Hazard. The potential hazards associated with these on-site ponds should be re-examined to determine the appropriate classification.

The Units 1 & 2 STEP Dam was classified (Maxim, 2005) as a High Hazard dam due to the high potential for loss of life and extensive property damage in the event of a failure. This hazard classification is considered appropriate.

The Units 3 & 4 EHP Dams were classified (Maxim, 2005) as Low Hazard dams based on interpreted minimal potential for damage and dissipation of the flood wave in a broad floodplain such that "slow flooding of residences" is possible. The EPA hazard potential classification indicates that Low Hazard Potential structures result in "low economic and/or environmental losses," while those with Significant Hazard Potential are "those dams where failure or misoperation…can cause economic loss, environmental damage, disruption of lifeline facilities…". We believe that the minimum appropriate classification for this dam is Significant Hazard based on potential for economic loss and environmental damage and that the dam may need to be classified as High Hazard based on the potential for loss of life due to flooding of inhabited structures and residences. We recommend that the hazard classification for this dam be re-evaluated to determine the appropriate classification.

12.0 Recommendations

12.1 Corrective Measures for the Structures

12.1.1 Units 1 & 2 Bottom Ash Pond Embankments

1. A check slope stability analysis was performed by GEI because an existing analysis was not available. The check stability analysis indicates the west embankment of the Bottom Ash Ponds meets the minimum required factors of safety in accordance with the FERC. However, we recommend that slope stability analyses be performed and documented for these embankments based on site-specific information.

2. Modify the 24-inch HDPE carrier pipe in the southwest corner of the west cell to prevent a potential seepage path at higher reservoir elevations through the HDPE lining to the interior of the embankment.

3. Remove the out-of-service box culvert located near the embankment crest on the east cell and backfill with engineered fill.

4. Implement rodent control measures on the downstream slope of the embankment to reduce the potential for shortened seepage pathways through the burrows.

5. Place engineered fill and regrade the downstream toe of the embankment to eliminate oversteepened slopes.

6. Remove and backfill the out-of-service manhole at the downstream toe of the northwest corner of the west cell to eliminate this potential seepage pathway. Careful construction is required working at the toe of a dam to not destabilize the slope.

7. Design and install piezometers to monitor water pressures in the embankment and foundation. Collect and evaluate data at least twice per year.

12.1.2 Units 1 & 2 "A" Pond Embankments

1. Slope stability check analyses performed by GEI indicate the south part of the west embankment of Pond "A" has a factor of safety that is somewhat less than required for the rapid drawdown loading condition. The application of a full rapid drawdown analysis to this pond is considered a conservative analysis and the resulting calculated factor of safety is considered adequate. We recommend further documentation of the

stability of these embankments be performed using site-specific soil strength information.

2. Implement rodent control measures on the downstream slope of the embankment to reduce the potential for shortened seepage pathways through the burrows.

3. Fill and regrade the oversteepened areas at the downstream toe of the embankment.

4. Design and install piezometers to monitor water pressures in the embankment and foundation. Collect and evaluate data at least twice per year.

12.1.3 Units 1 & 2 STEP Dam

1. Correct the low area of the dam crest at the right abutment by placing engineered fill.

2. Repair the erosion on the upstream slope near the right groin. Correct surface water run-on to eliminate the water source for future erosion. Repair the minor surface erosion on the upstream and downstream slopes of the STEP Dam.

3. Design and install piezometers and movement monuments in the dam to monitor water pressures and displacement. Install a means of measuring seepage flow collected by the internal drain system. Collect and evaluate data at least twice per year.

12.1.4 Units 3 & 4 EHP Main Dam

1. Design and install additional instrumentation in the dam and sandstone layer in the dam abutments. Some of these instruments should obtain data in the downstream shell and in the abutment at a location downstream of the core. Collect and evaluate data at least twice per year.

2. Perform seepage and stability analyses to develop understanding of the potentially critical abutment seepage conditions in the baked shale and sandstone layer with respect to potential for seepage erosion at the dam-abutment contact and the generation of high pore pressures in the downstream shell.

3. Continue to monitor water levels in the dam and abutments and the associated seep that surfaces downstream of the Main Dam and the 1999 seep area downstream of the Saddle Dam.

4. Evaluate and document whether the small saddle fill located about 500 feet left of the left abutment functions as part of the Main Dam. If determined to be part of the

Main Dam, the fill should be analyzed for slope stability and inspected regularly like other portions of the dam.

5. Implement rodent control measures on the downstream slope of the dam to reduce the potential for seepage through burrows.

6. Continue to monitor and repair minor surface erosion rills on the downstream slope of the Main Dam.

7. Maintain the free water level restriction in the Old Clearwell at a maximum of El. 3,238.

12.1.5 Units 3 & 4 EHP Saddle Dam

1. The 1999 seepage event that resulted in internal erosion of the Saddle Dam embankment and core was addressed by lowering and restricting the water level behind the dam, but no repairs were made to the dam. The water level restriction that was established in December 1999 should be continued and storage for the appropriate inflow design flood maintained. The dam is not considered safe if water levels are allowed to rise significantly above El. 3,237 because the potential for internal seepage erosion remains. PPL has noted that their studies attribute the seepage event to differential settlement at the concrete cutoff wall location between the upstream, saturated, part of the embankment, which settled, and the downstream part, which did not settle. However, the EHP ponds impounded by the Saddle Dam are currently being filled with paste consisting of 68 percent solids that cures to a solid. Filling the ponds with paste could greatly reduce seepage pressures on the dams and an engineering analysis of the potential to store paste above the restriction level should be documented.

2. Backfill the test pit located on the downstream slope of the dam after repairing the damaged toe drain pipe and restoring the granular drain materials.

3. Continue to monitor and repair minor surface erosion rills on the downstream slope of the Saddle Dam.

4. Maintain the free water level restriction in the “G” cell at a maximum of El. 3,237.

5. Evaluate the high water level readings in two Saddle Dam piezometers that indicate minimal head loss between the reservoir and the piezometers.

12.2 Corrective Measures Required for Maintenance and Surveillance Procedures

None.

12.3 Corrective Measures Required for the Methods of Operation of the Project Works

None.

12.4 Any New or Additional Monitoring Instruments, Periodic Observations, or Other Methods of Monitoring Project Works or Conditions That May Be Required

The visual inspections and the instrumentation monitoring plan currently in place for the impoundments generally appears to be adequate.

The instrumentation for the dams is inadequate. Install additional instruments in the Units 3 & 4 Main Dam to enable engineering evaluation of water pressures within the core and downstream shell and within the abutment sandstone layer downstream of the core. Install instruments for monitoring water pressures and movement within the Units 1 & 2 STEP dam embankment and in the abutments, particularly the left abutment that is protected by the upstream soil blanket. Install instruments for monitoring water pressures within the Units 1 & 2 Bottom Ash and "A" Pond embankments.

12.5 Acknowledgement of Assessment

I acknowledge that the management unit(s) referenced herein was personally inspected by me and was found to be in the following condition **(select one only):**

SATISFACTORY

FAIR

POOR

UNSATISFACTORY

SATISFACTORY
No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.

FAIR
Acceptable performance is expected under all required loading conditions (static, hydrologic, seismic) in accordance with the applicable safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations

POOR
A management unit safety deficiency is recognized for any required loading condition (static, hydrologic, seismic) in accordance with the applicable dam safety regulatory criteria. Remedial action is necessary. POOR also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.

UNSATISFACTORY
Considered unsafe. A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution. Reservoir restrictions may be necessary.

I acknowledge that the management unit referenced herein:

Has been assessed on June 2 & 3, 2009 (date)

Signature: S G Brown

COLORADO REGISTERED
STEPHEN G. BROWN
9-14-09
26679
PROFESSIONAL ENGINEER

List of Participants:

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Mike Holzwarth	PPL Montana
Steve Christian	PPL Montana
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13.0 References

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Hydrometrics, Inc., 2001, Units 3 & 4 EHP Main Dam Stability Analyses, Revised, December.

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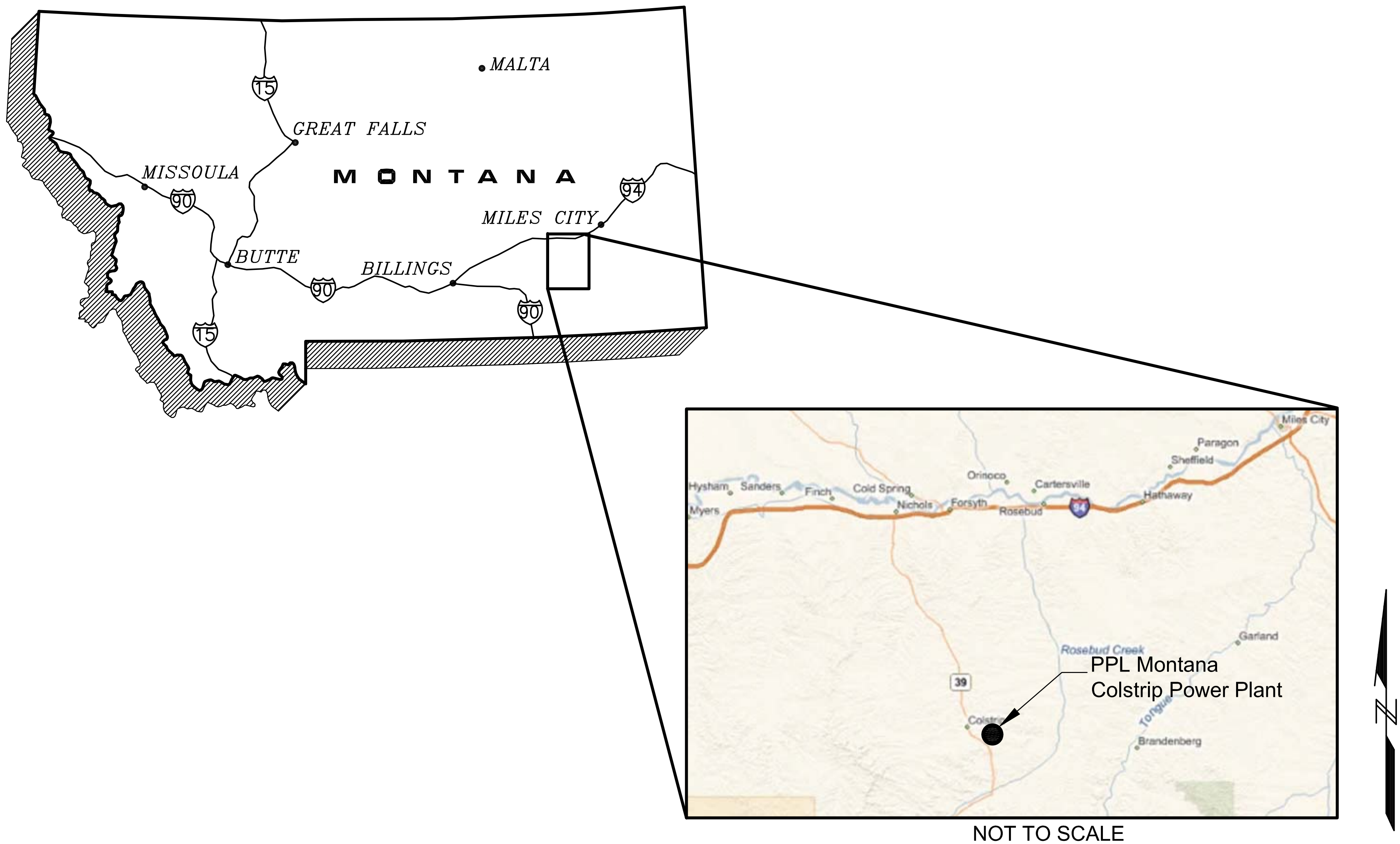
Maxim Technologies (Maxim), 2006, 2005 Phase 1 Inspection, Units 3 & 4 Main and Saddle Dams, January.

Portage Environmental, Inc. (Portage) and HKM Engineering, Inc., 2005, PPL/Colstrip Fly Ash Pond Design and Construction Report, August.

Womack & Associates, Inc., 2009, 3/4 EHP Main Dams Observations and Stability Review Update, May.

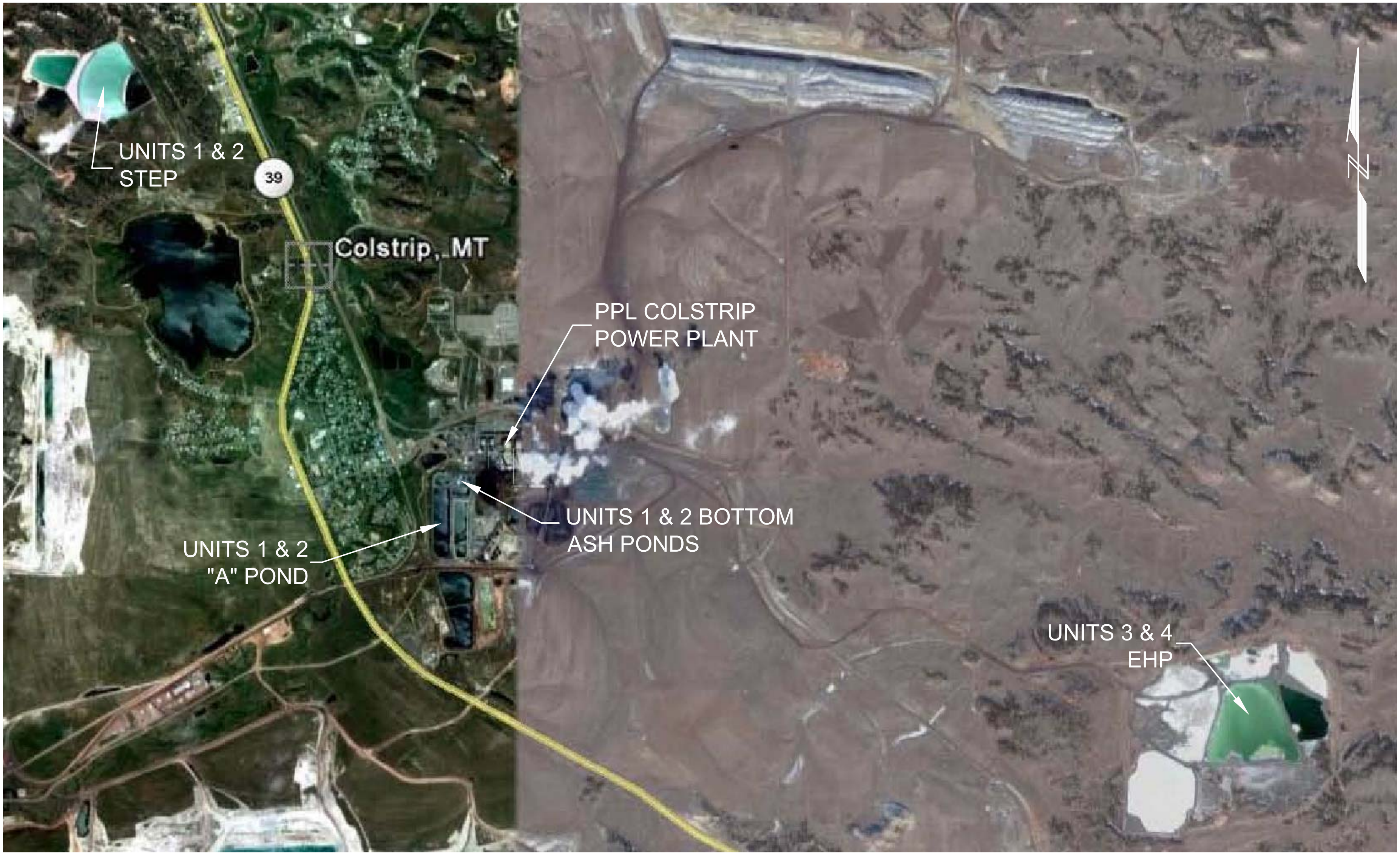
Figures and Exhibits

P:\091330 - Lockheed Martin Coal Ash Impoundments\PPL- Colstrip\ FIGURE 1 SITE VICINITY MAP.dwg Sep 2009



NOT TO SCALE

Assessment of Dam Safety PPL Montana: Colstrip Power Plant	GEI Consultants	SITE VICINITY MAP	
Lockheed-Martin Corporation Edison, NJ	Project 091330	September 2009	Figure 1



NOT TO SCALE

Assessment of Dam Safety PPL Montana Colstrip Power Plant	GEI Consultants	SITE MAP	
Lockheed-Martin Corporation Edison, NJ	Project 091330	September 2009	Figure 2

NOT TO SCALE

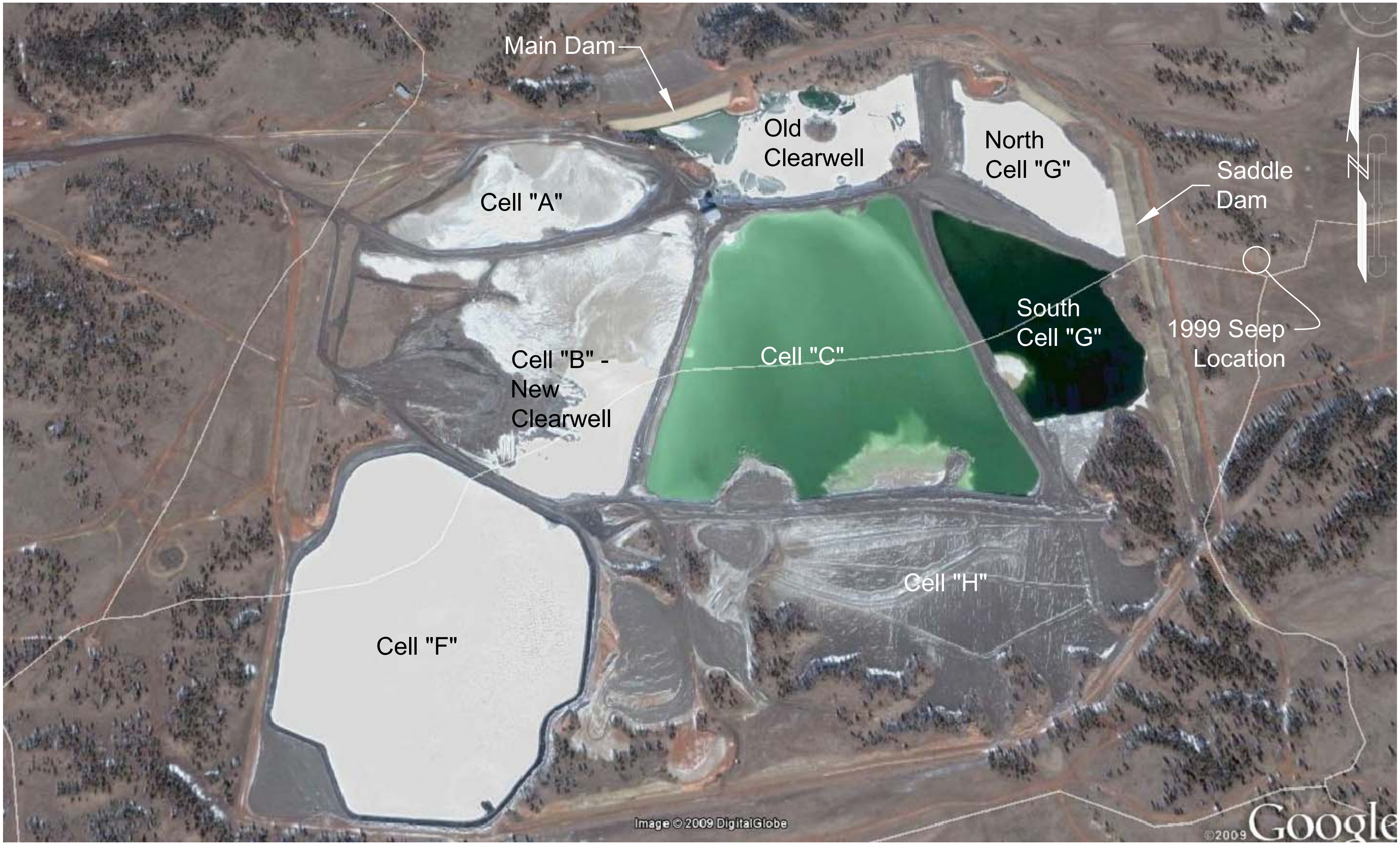
Assessment of Dam Safety PPL Montana Colstrip Power Plant	GEI Consultants	On-Site Ponds
Lockheed-Martin Corporation Edison, NJ	Project 091330	September 2009 Figure 3

P:\091330 - Lockheed Martin Coal Ash Impoundments\PPL- Colstrip\ Figures 3-5.dwg Sep 2009

NOT TO SCALE

Assessment of Dam Safety PPL Montana Colstrip Power Plant	GEI Consultants	Units 1 & 2 Second Stage Evaporation Ponds	
Lockheed-Martin Corporation Edison, NJ	Project 091330	September 2009	Figure 4

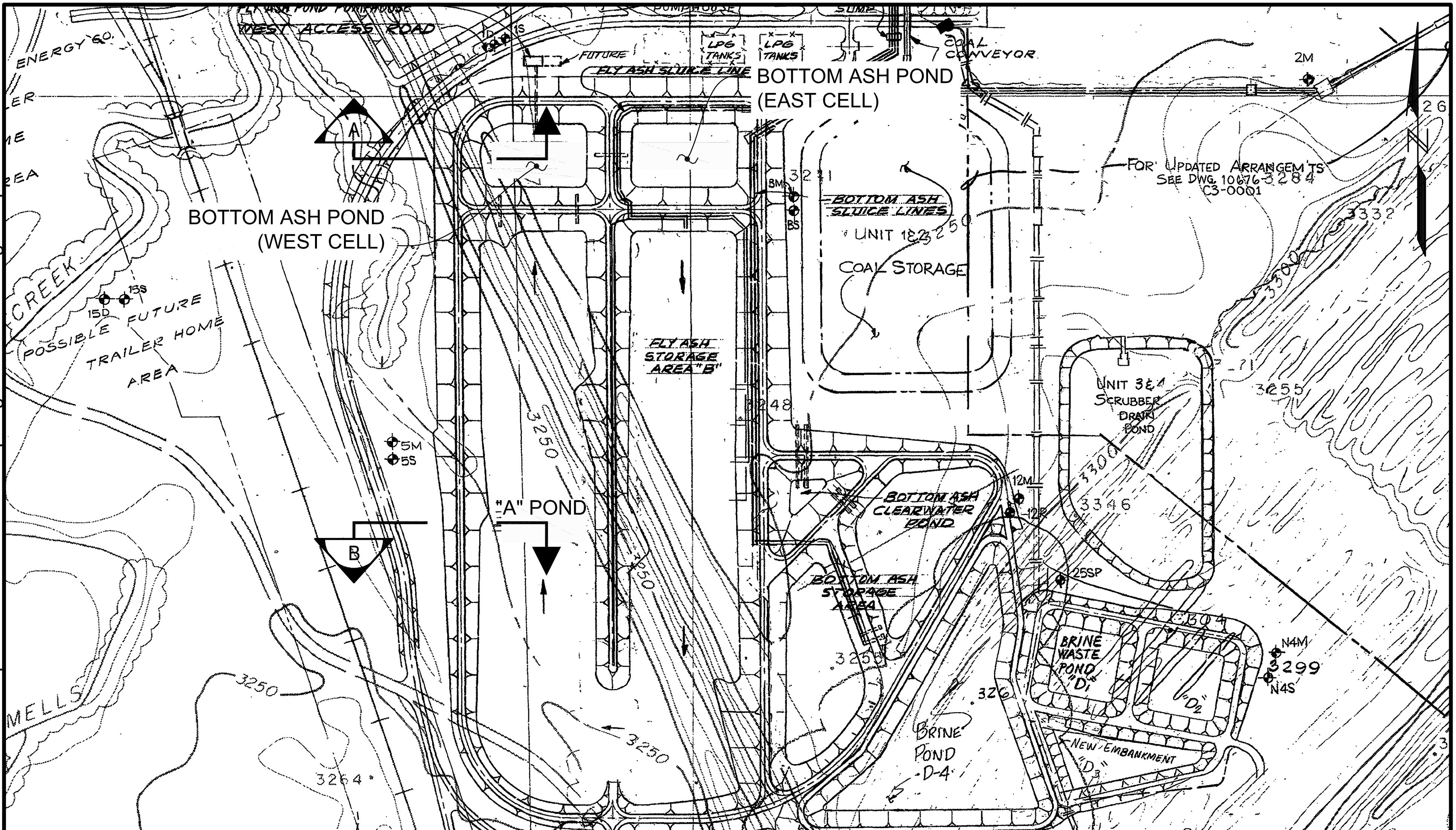
P:\091330 - Lockheed Martin Coal Ash Impoundments\PPL- Colstrip\ Figures 3-5.dwg Sep 2009



NOT TO SCALE

Assessment of Dam Safety PPL Montana Colstrip Power Plant	GEI Consultants	Units 3 & 4 Effluent Holding Ponds
Lockheed-Martin Corporation Edison, NJ	Project 091330	September 2009 Figure 5

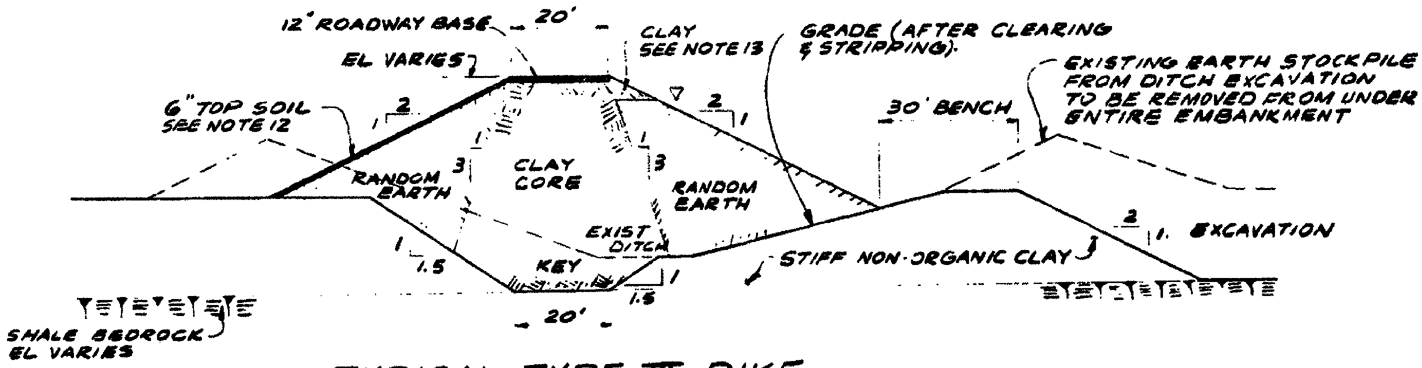
P:\091330 - Lockheed Martin Coal Ash Impoundments\PPL- Colstrip\ Figures 6 and 7.dwg Sep 2009



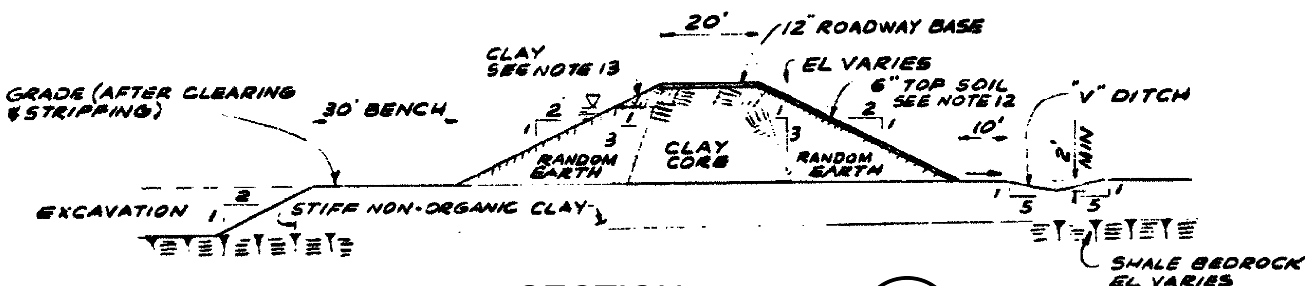
0 200 400 800 1200
SCALE IN FEET

NOTES:
1. PLAN TAKEN FROM THE DRAWING TITLED "GENERAL PLOT PLAN FOR PONDS" DRAWING NO. C-1-25, PREPARED BY BECHTEL, REVISED JANUARY 9, 1984.
2. SEE FIGURE 7 FOR SECTIONS.

Assessment of Dam Safety PPL Montana: Colstrip Power Plant	GEI Consultants	UNITS 1 & 2 BOTTOM ASH AND "A" POND-PLAN
Lockheed-Martin Corporation Edison, New Jersey	Project 091330	September 2009 Figure 6



SECTION A



SECTION B

0 20 40 80 120

SCALE IN FEET

NOTES:

1. PLAN TAKEN FROM THE DRAWING TITLED "BOTTOM AND FLY ASH SECTIONS" DRAWING NO. C1-32, PREPARED BY BECHTEL, REVISION 4.
2. SEE FIGURE 6 FOR SECTION LOCATIONS.

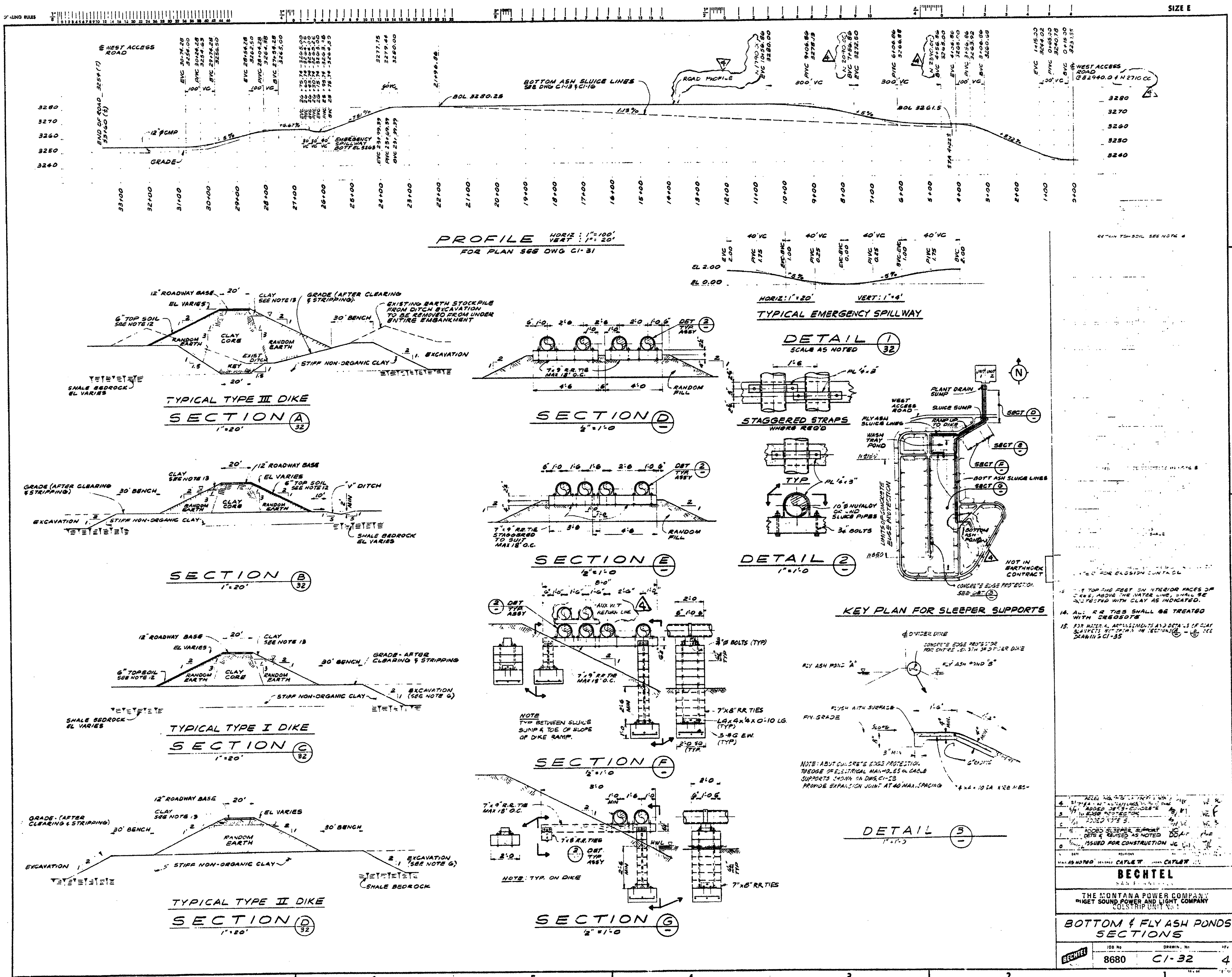
Assessment of Dam Safety
PPL Montana: Colstrip Power Plant

Lockheed-Martin Corporation
Edison, New Jersey

GEI Consultants

UNITS 1 & 2 BOTTOM ASH AND "A" POND-EMBANKMENT SECTIONS

Project 091330 | September 2009 | Figure 7



PROFILE HORIZ: 1"=100' VERT: 1"=20'
FOR PLAN SEE DWG C1-31
BOTTOM ASH SLUICE LINES SEE DWG C1-13 & C1-16
ROAD PROFILE
EL 3280.25
12" CGMP
GRADE
EMERGENCY SPILLWAY BOTT EL 3263
TYPICAL EMERGENCY SPILLWAY
HORIZ: 1"=20'
VERT: 1"=4'
12" ROADWAY BASE
EL VARIES
CLAY SEE NOTE 13
GRADE (AFTER CLEARING & STRIPPING)
EXISTING EARTH STOCKPILE FROM DITCH EXCAVATION TO BE REMOVED FROM UNDER ENTIRE EMBANKMENT
6" TOP SOIL SEE NOTE 12
30' BENCH
RANDOM EARTH
CLAY CORE
KEY
EXIST DITCH
STIFF NON-ORGANIC CLAY
EXCAVATION
SHALE BEDROCK EL VARIES
TYPICAL TYPE III DIKE
SECTION A 32
1"=20'
SECTION B 32
1"=20'
"V" DITCH
TYPICAL TYPE I DIKE
SECTION C 32
1"=20'
TYPICAL TYPE II DIKE
SECTION D 32
1"=20'
SECTION D
1/2"=1'-0
SECTION E
1/2"=1'-0
SECTION F
1/2"=1'-0
SECTION G
1/2"=1'-0
RANDOM FILL
7"x9" RR TIES MAX 15' O.C.
DET 2 TYP ASSY
7"x8" RR TIES
3/4"Ø BOLTS (TYP)
NOTE: TYP BETWEEN SLUICE SUMP & TOE OF SLOPE OF DIKE RAMP.
NOTE: TYP. ON DIKE
DETAIL 1 32
SCALE AS NOTED
STAGGERED STRAPS
WHERE REQ'D
TYP
10" NUVALOY OR 10" SLUICE PIPES
3/4" BOLTS
DETAIL 2
1"=1'-0
KEY PLAN FOR SLEEPER SUPPORTS
PLANT DRAIN SUMP
SLUICE SUMP
WEST ACCESS ROAD
FLY ASH SLUICE LINES
WASH TRAY POND
BOTT ASH SLUICE LINES
BOTTOM ASH POND
NOT IN EARTHWORK CONTRACT
DETAIL 3
NOTE: ABUT CONCRETE EDGE PROTECTION TO EDGE OF ELECTRICAL MANHOLES & CABLE SUPPORTS SHOWN ON DWG C1-23. PROVIDE EXPANSION JOINT AT 40' MAX SPACING.
14. ALL RR TIES SHALL BE TREATED WITH CREOSOTE
ISSUED FOR CONSTRUCTION
BECHTEL
THE MONTANA POWER COMPANY
PUGET SOUND POWER AND LIGHT COMPANY
COLSTRIP UNIT No 1
BOTTOM & FLY ASH PONDS SECTIONS
8680
C1-32
4
SIZE E

EXHIBIT 1

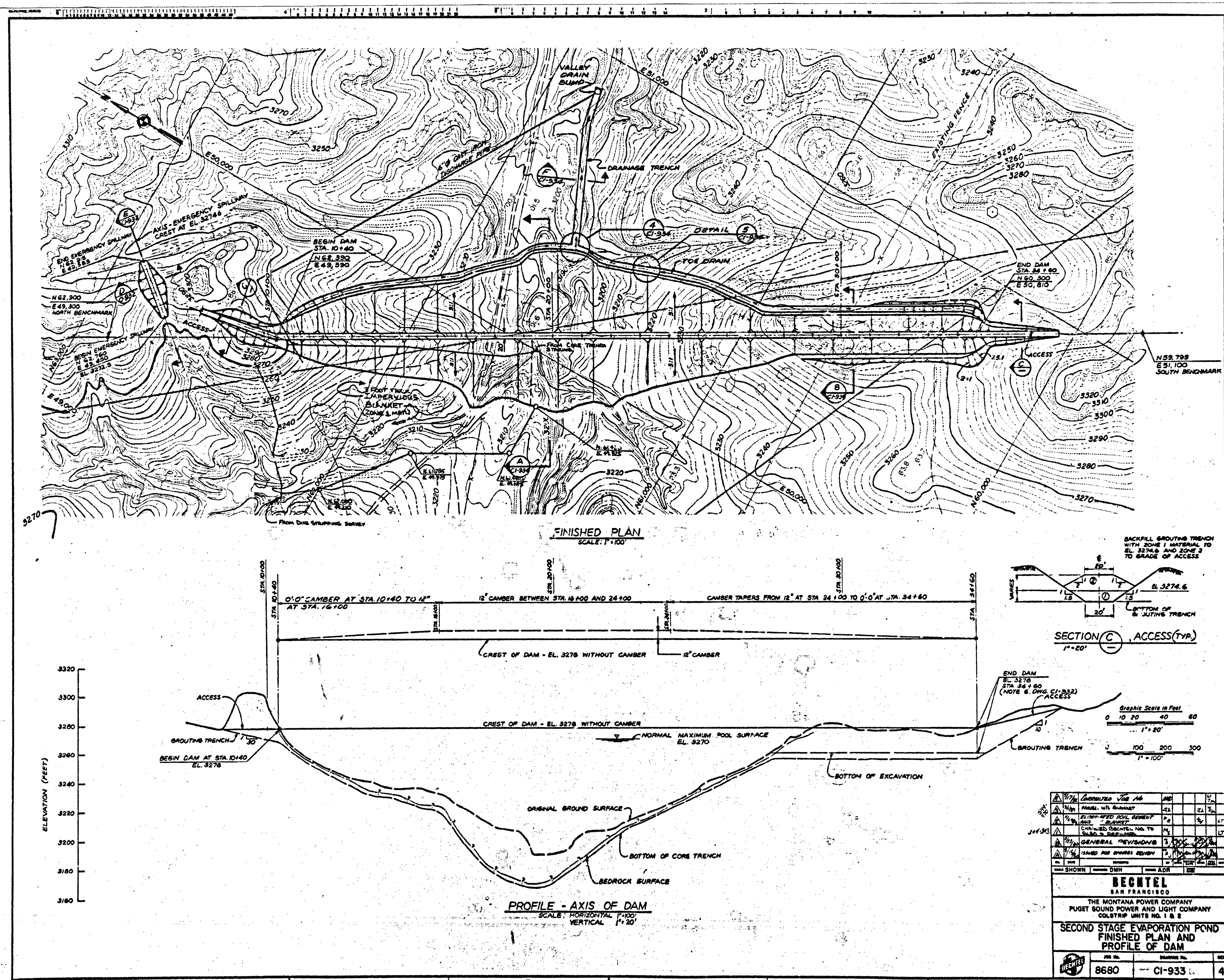

FINISHED PLAN
SCALE: 1"=100'
VALLEY DRAIN SUMP
DRAINAGE TRENCH
DETAIL
TOE DRAIN
AXIS EMERGENCY SPILLWAY CREST AT EL. 3274.6
END EMERGENCY SPILLWAY
BEGIN EMERGENCY SPILLWAY
BEGIN DAM STA. 10+40
N62,390
E49,590
N62,900
E49,300
NORTH BENCHMARK
ACCESS
END DAM STA. 34+60
N60,300
E50,810
N59,795
E51,100
SOUTH BENCHMARK
EXISTING FENCE
FROM CORE TRENCH STRIPPING
FROM DIKE STRIPPING SURVEY
BACKFILL GROUTING TRENCH WITH ZONE 1 MATERIAL TO EL. 3274.6 AND ZONE 3 TO GRADE OF ACCESS
SECTION C ACCESS (TYP.)
1"=20'
0'-0" CAMBER AT STA. 10+40 TO 12" AT STA. 16+00
12" CAMBER BETWEEN STA. 16+00 AND 24+00
CAMBER TAPERS FROM 12" AT STA 24+00 TO 0'-0" AT STA. 34+60
CREST OF DAM - EL. 3278 WITHOUT CAMBER
12" CAMBER
ACCESS
GROUTING TRENCH
BEGIN DAM AT STA. 10+40 EL. 3278
CREST OF DAM - EL. 3278 WITHOUT CAMBER
NORMAL MAXIMUM POOL SURFACE EL. 3270
END DAM EL. 3278 STA 34+60 (NOTE 6, DWG. CI-932)
BOTTOM OF EXCAVATION
ORIGINAL GROUND SURFACE
BOTTOM OF CORE TRENCH
BEDROCK SURFACE
ELEVATION (FEET)
Graphic Scale in Feet
1"=20'
1"=100'
PROFILE - AXIS OF DAM
SCALE: HORIZONTAL 1"=100'
VERTICAL 1"=20'
GENERAL REVISIONS
ISSUED FOR OWNERS REVIEW
SHOWN
DMH
ADR
BECHTEL
SAN FRANCISCO
THE MONTANA POWER COMPANY
PUGET SOUND POWER AND LIGHT COMPANY
COLSTRIP UNITS NO. 1 & 2
SECOND STAGE EVAPORATION POND
FINISHED PLAN AND
PROFILE OF DAM
8680
CI-933
4

EXHIBIT 2

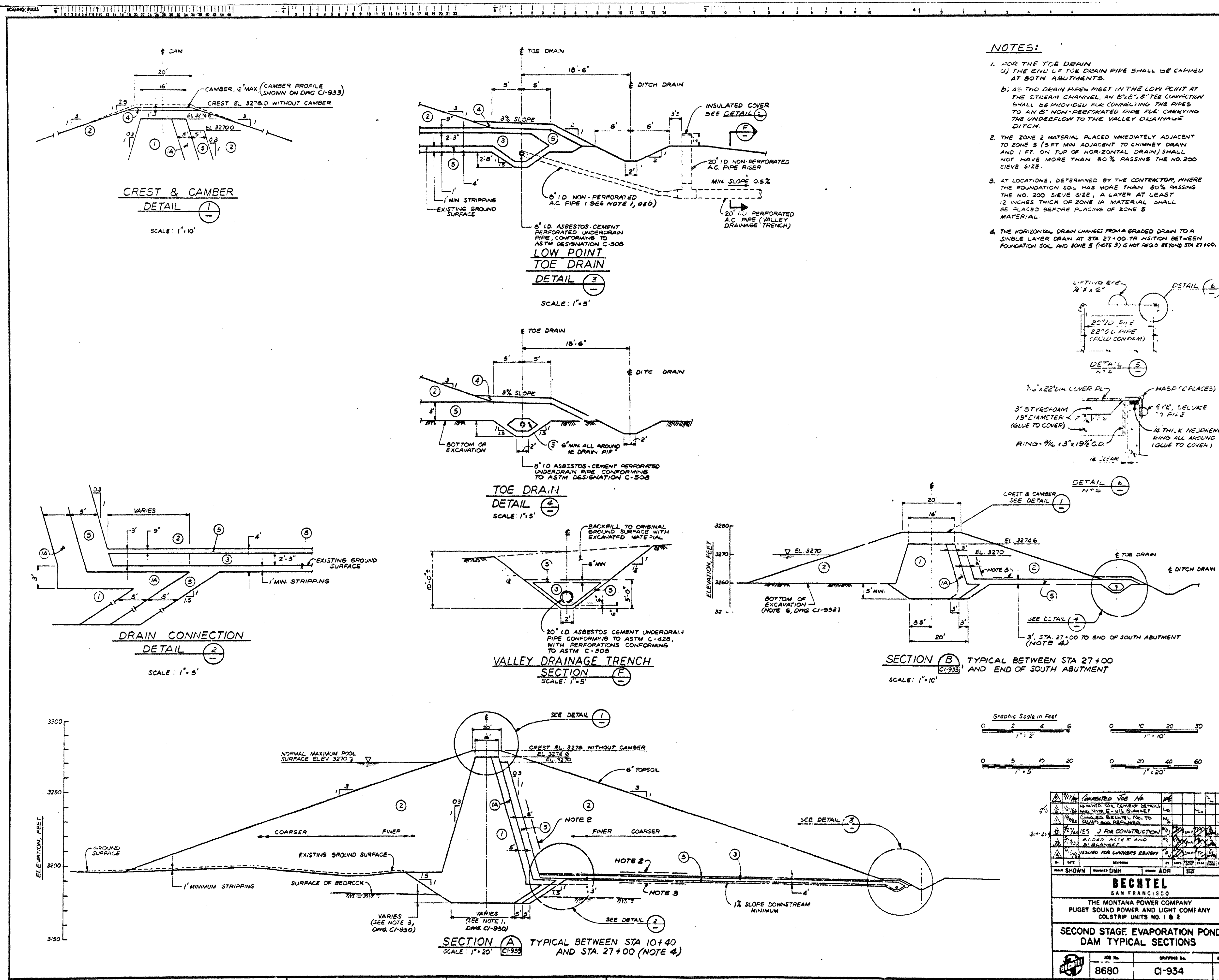
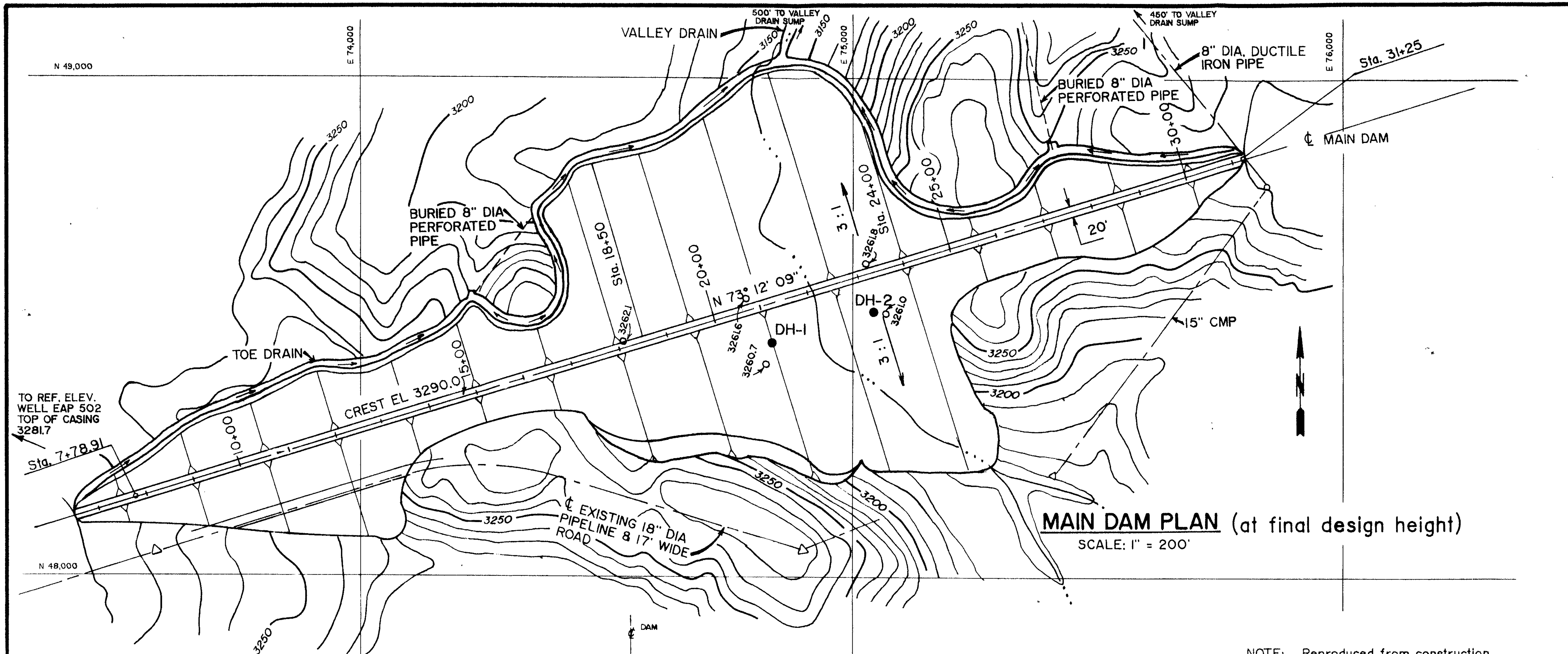

NOTES:
1. FOR THE TOE DRAIN
a) THE END OF THE DRAIN PIPE SHALL BE CAPPED AT BOTH ABUTMENTS.
b) AS TWO DRAIN PIPES MEET IN THE LOW POINT AT THE STREAM CHANNEL, AN 8"x8"x8" TEE CONNECTION SHALL BE PROVIDED FOR CONNECTING THE PIPES TO AN 8" NON-PERFORATED PIPE FOR CARRYING THE UNDERFLOW TO THE VALLEY DRAINAGE DITCH.
2. THE ZONE 2 MATERIAL PLACED IMMEDIATELY ADJACENT TO ZONE 5 (5 FT MIN. ADJACENT TO CHIMNEY DRAIN AND 1 FT. ON TOP OF HORIZONTAL DRAIN) SHALL NOT HAVE MORE THAN 80% PASSING THE NO. 200 SIEVE SIZE.
3. AT LOCATIONS, DETERMINED BY THE CONTRACTOR, WHERE THE FOUNDATION SOIL HAS MORE THAN 80% PASSING THE NO. 200 SIEVE SIZE, A LAYER AT LEAST 12 INCHES THICK OF ZONE 1A MATERIAL SHALL BE PLACED BEFORE PLACING OF ZONE 5 MATERIAL.
4. THE HORIZONTAL DRAIN CHANGES FROM A GRADED DRAIN TO A SINGLE LAYER DRAIN AT STA 27+00. TRANSITION BETWEEN FOUNDATION SOIL AND ZONE 5 (NOTE 3) IS NOT REQ'D BEYOND STA 27+00.
CREST & CAMBER
DETAIL 1
SCALE: 1"=10'
CAMBER, 12" MAX (CAMBER PROFILE SHOWN ON DWG CI-933)
CREST EL 3278.0 WITHOUT CAMBER
EL 3274.6
EL 3270.0
LOW POINT
TOE DRAIN
DETAIL 3
SCALE: 1"=5'
INSULATED COVER SEE DETAIL 5
20" I.D. NON-PERFORATED A.C. PIPE RISER
MIN SLOPE 0.5%
8" I.D. NON-PERFORATED A.C. PIPE (SEE NOTE 1, a&b)
20" I.D. PERFORATED A.C. PIPE (VALLEY DRAINAGE TRENCH)
8" I.D. ASBESTOS-CEMENT PERFORATED UNDERDRAIN PIPE, CONFORMING TO ASTM DESIGNATION C-508
1' MIN STRIPPING
EXISTING GROUND SURFACE
3% SLOPE
DITCH DRAIN
TOE DRAIN
TOE DRAIN
DETAIL 4
SCALE: 1"=5'
BOTTOM OF EXCAVATION
6" MIN. ALL AROUND THE DRAIN PIPE
8" I.D. ASBESTOS-CEMENT PERFORATED UNDERDRAIN PIPE CONFORMING TO ASTM DESIGNATION C-508
DRAIN CONNECTION
DETAIL 2
SCALE: 1"=5'
EXISTING GROUND SURFACE
1' MIN. STRIPPING
VALLEY DRAINAGE TRENCH
SECTION F
SCALE: 1"=5'
BACKFILL TO ORIGINAL GROUND SURFACE WITH EXCAVATED MATERIAL
20" I.D. ASBESTOS CEMENT UNDERDRAIN PIPE CONFORMING TO ASTM C-428, WITH PERFORATIONS CONFORMING TO ASTM C-508
SECTION B TYPICAL BETWEEN STA 27+00 AND END OF SOUTH ABUTMENT
SCALE: 1"=10'
CREST & CAMBER SEE DETAIL 1
EL. 3274.6
EL. 3270
BOTTOM OF EXCAVATION (NOTE 6, DWG. CI-932)
5' MIN.
SEE DETAIL 4
3', STA. 27+00 TO END OF SOUTH ABUTMENT (NOTE 4)
DITCH DRAIN
SECTION A TYPICAL BETWEEN STA 10+40 AND STA. 27+00 (NOTE 4)
SCALE: 1"=20'
NORMAL MAXIMUM POOL SURFACE ELEV. 3270
CREST EL. 3278 WITHOUT CAMBER
EL 3274.6
EL 3270
6" TOPSOIL
SEE DETAIL 1
SEE DETAIL 3
SEE DETAIL 2
GROUND SURFACE
EXISTING GROUND SURFACE
SURFACE OF BEDROCK
1' MINIMUM STRIPPING
COARSER
FINER
NOTE 2
NOTE 3
1% SLOPE DOWNSTREAM MINIMUM
VARIES (SEE NOTE 3, DWG. CI-930)
VARIES (SEE NOTE 1, DWG. CI-930)
ELEVATION, FEET
Graphic Scale in Feet
DETAIL 5
DETAIL 6
BECHTEL
SAN FRANCISCO
THE MONTANA POWER COMPANY
PUGET SOUND POWER AND LIGHT COMPANY
COLSTRIP UNITS NO. 1 & 2
SECOND STAGE EVAPORATION POND DAM TYPICAL SECTIONS
8680
CI-934
3

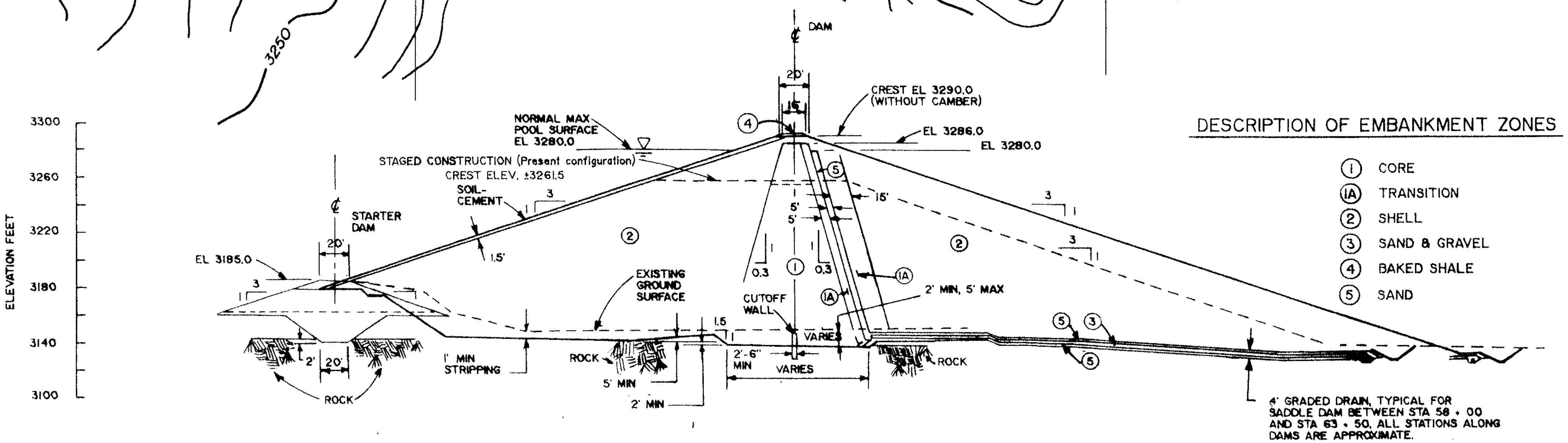
EXHIBIT 3



MAIN DAM PLAN (at final design height)

SCALE: 1" = 200'

NOTE: Reproduced from construction drawings by Bechtel Power Co.



TYPICAL DAM CROSS-SECTION

SCALE: 1" = 100'

DESCRIPTION OF EMBANKMENT ZONES

1 CORE
1A TRANSITION
2 SHELL
3 SAND & GRAVEL
4 BAKED SHALE
5 SAND

MONTANA POWER COMPANY
COLSTRIP, MONTANA

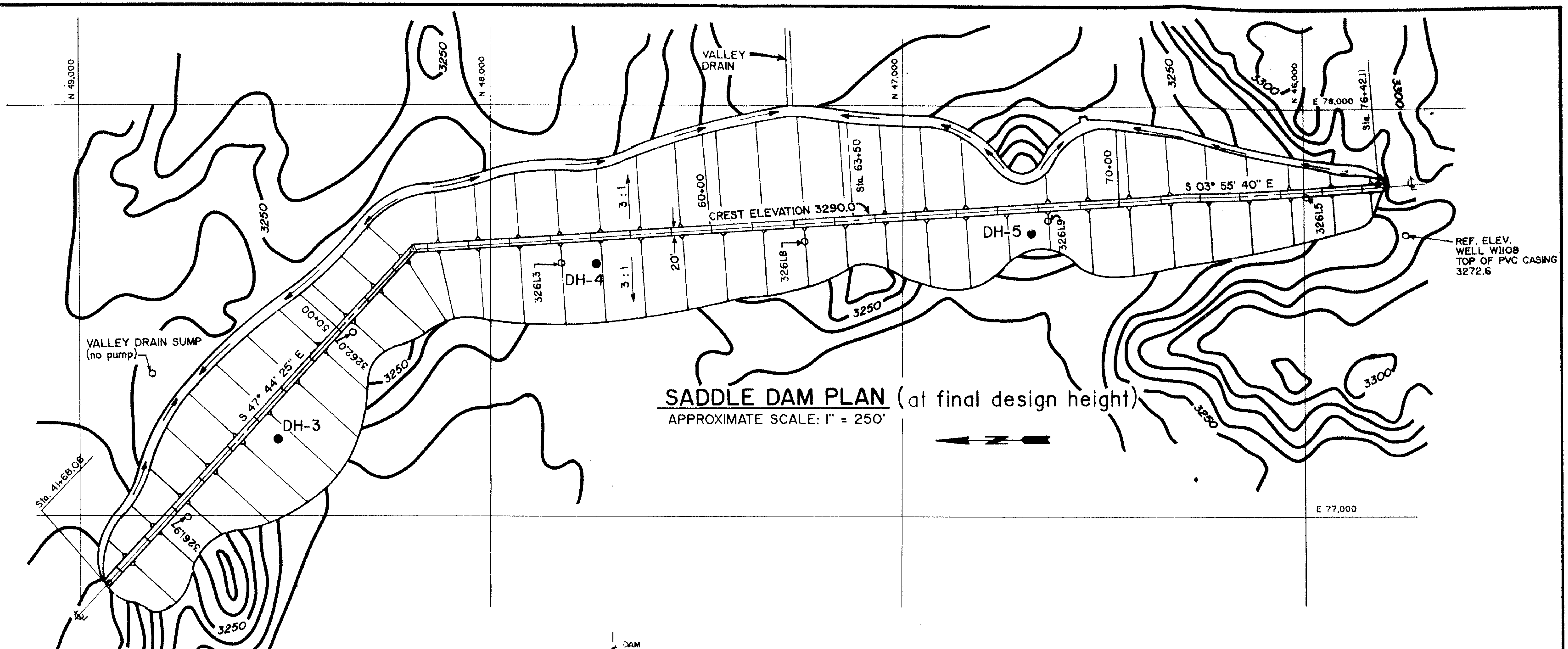
UNITS 3 & 4 EFFLUENT HOLDING POND
COLSTRIP, MONTANA

Chen-Northern, Inc.
Consulting Engineers and Scientists

Drawn: LNR
Checked: JMP
Scale: As Shown
Date: 11/13/89

JOB NO.: 89-576
Dr.# 89-576-1

EXHIBIT 4



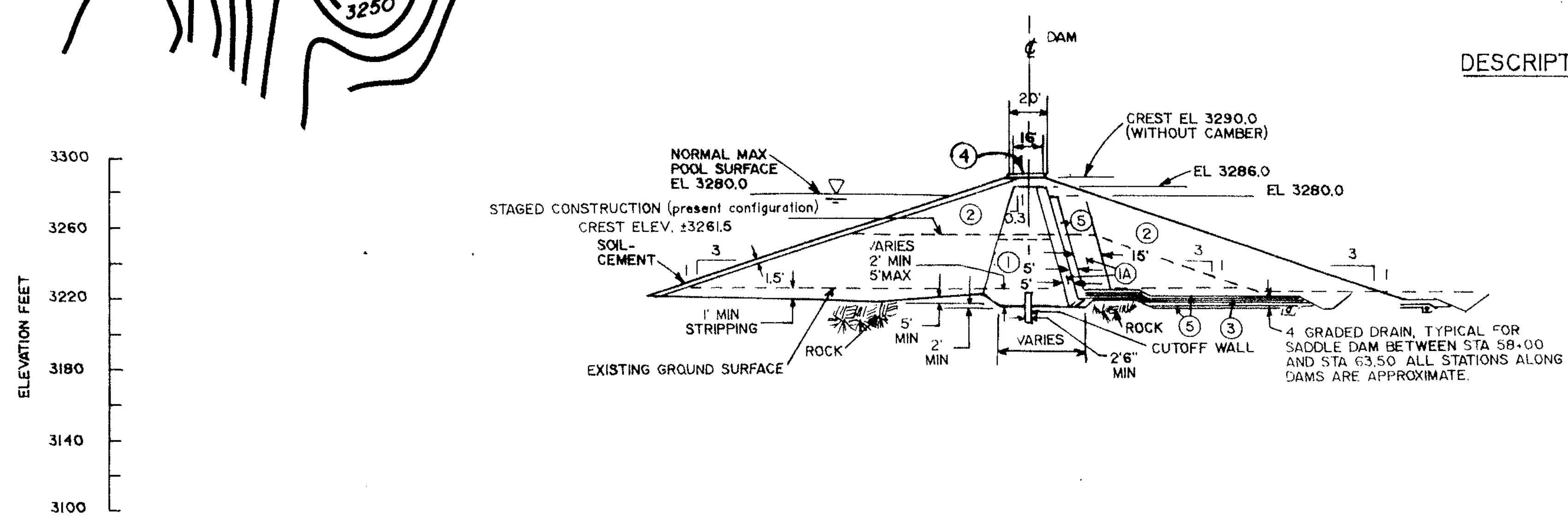
SADDLE DAM PLAN (at final design height)

APPROXIMATE SCALE: 1" = 250'

DESCRIPTION OF EMBANKMENT ZONES

1. CORE
1A. TRANSITION
2. SHELL
3. SAND & GRAVEL
4. BAKED SHALE
5. SAND

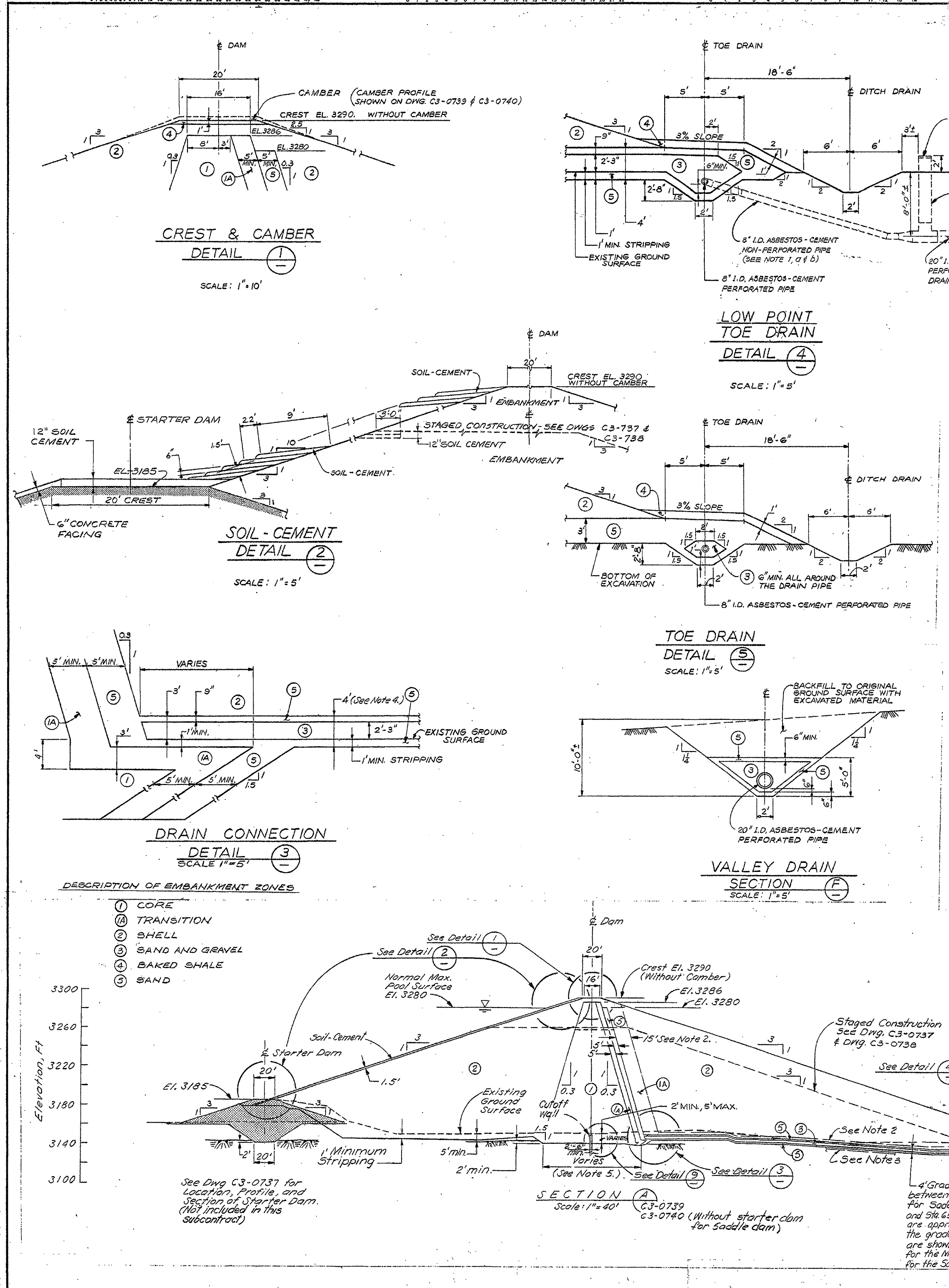
NOTE: Reproduced from construction drawings by Bechtel Power Co.



TYPICAL DAM CROSS-SECTION

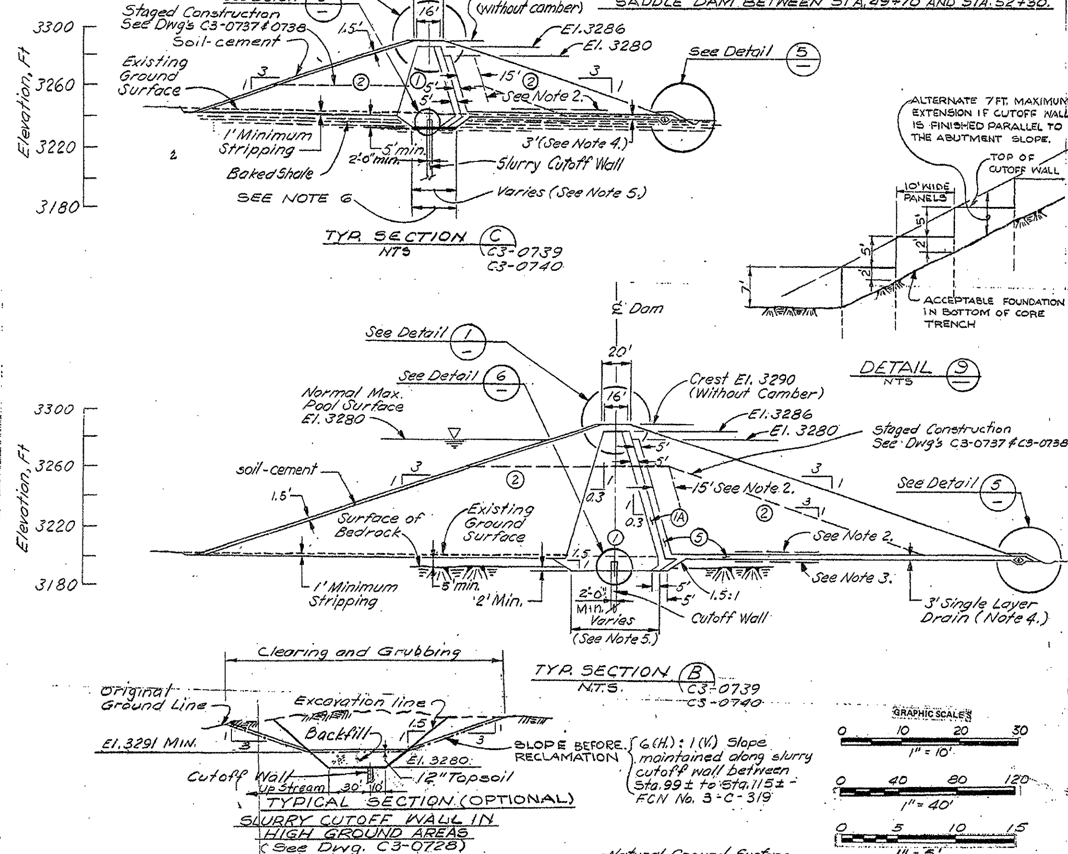
APPROXIMATE SCALE: 1" = 100'

MONTANA POWER COMPANY COLSTRIP, MONTANA UNITS 3 & 4 EFFLUENT HOLDING POND COLSTRIP, MONTANA	
Chen-Northern, Inc. Consulting Engineers and Scientists	Drawn: LNR Checked: JMP Scale: As Shown Date: 11/13/89
	JOB NO.: 89-576
	DR.# 89-576-2



NOTES:

1. TOE DRAIN
   a) THE END OF TOE DRAIN PIPE SHALL BE CAPPED AT BOTH ABUTMENTS.
   b) WHERE THE TWO DRAIN PIPES MEET IN THE LOW POINT AT THE STREAM CHANNEL, AN 8"x8"x8" TEE CONNECTION SHALL BE PROVIDED FOR CONNECTING THE PIPES TO AN 8" NON-PERFORATED PIPE FOR CARRYING THE UNDERFLOW TO THE VALLEY DRAINAGE DITCH.
2. THE PERCENTAGE FINES PASSING NO. 200 U.S. SIEVE FOR THE ZONE 2 MATERIAL PLACED IMMEDIATELY ADJACENT TO ZONE 5 MATERIAL (15 FT MIN. ADJACENT TO CHIMNEY DRAIN AND 1 FT MIN. ON TOP OF HORIZONTAL DRAIN) SHALL BE NOT MORE THAN 80 PERCENT.
3. AT LOCATIONS, DETERMINED BY THE CONTRACTOR, WHERE THE FOUNDATION SOIL HAS MORE THAN 80% PASSING THE NO. 200 SIEVE SIZE, A LAYER OF 1 FT MIN. OF ZONE 1A SHALL BE PLACED BEFORE PLACING OF ZONE 5 MATERIAL.
4. GRADED DRAIN (SEE SECTION A AND DETAILS 3 AND 4) IS USED IN THE MAIN DAM BETWEEN STA. 18+50 AND STA. 24+00, AND IN THE SADDLE DAM BETWEEN STA. 58+00 AND STA. 65+50.
   SINGLE ZONE DRAIN (SEE SECTIONS B AND C, AND DETAIL 5) IS USED IN ALL OTHER AREAS.
5. EXCAVATION DIMENSIONS OF CORE TRENCH ARE SHOWN ON DWG. C3-0734 (MAIN DAM) AND DWG. C3-0735 (SADDLE DAM).
6. ALL EXPOSED BAKED SHALE FOUNDATION SHALL BE INSPECTED BY THE CONTRACTOR TO DETERMINE THE CHARACTER OF THE FOUNDATION, THE LIMITS OF TYPES OF MATERIAL AND THE TREATMENT THEY WILL RECEIVE. BAKED SHALE WITH SOIL CHARACTERISTICS SHALL BE WETTED AND COMPACTED. BAKED SHALE FOUNDATIONS WITH ROCK CHARACTERISTICS BENEATH THE BOTTOM OF THE CORE TRENCH ONLY SHALL BE CLEANED AND TREATED WITH 4" CONCRETE.
7. BLANKET DRAIN WAS NOT INSTALLED IN THE SADDLE DAM BETWEEN STA. 49+70 AND STA. 52+30.



No.	DATE	REVISIONS	BY	CHKD.	DESIGN SUPV	ENGR	PROJ ENGR	APPR
0	3/4/83	ISSUED FOR AWARD & CONSTRUCTION OF S/C C076, PLAN B & S/C C077, STAGE 2.	WDJ	MD	MD		SAB	[illegible]
E	12/22/82	MINOR REVISION	WDJ	DMH	DMH		SAB	[illegible]
D	12/2/82	ISSUED FOR BIDS	WDJ	DMH	DMH		SAB	[illegible]
3	3/5/85	ADDED STAGED CONSTRUCTION & FCN-3C-291, FINAL ISSUE	WDJ	MD	MD		WE	RJD
2	10/5/83	REVISED SECTION-C	WDJ	DMH	DMH		WE	RJD
1	5/2/83	REVISED DETAIL 9	WDJ	[illegible]	[illegible]		WE	RJD

SCALE AS SHOWN — DESIGNED D.M.H. — DRAWN CAW/WDJ — CHIEF ENGR

BECHTEL
SAN FRANCISCO

COLSTRIP UNITS 3 & 4
COLSTRIP, MONTANA

EFFLUENT HOLDING POND
TYPICAL SECTIONS AND DETAILS

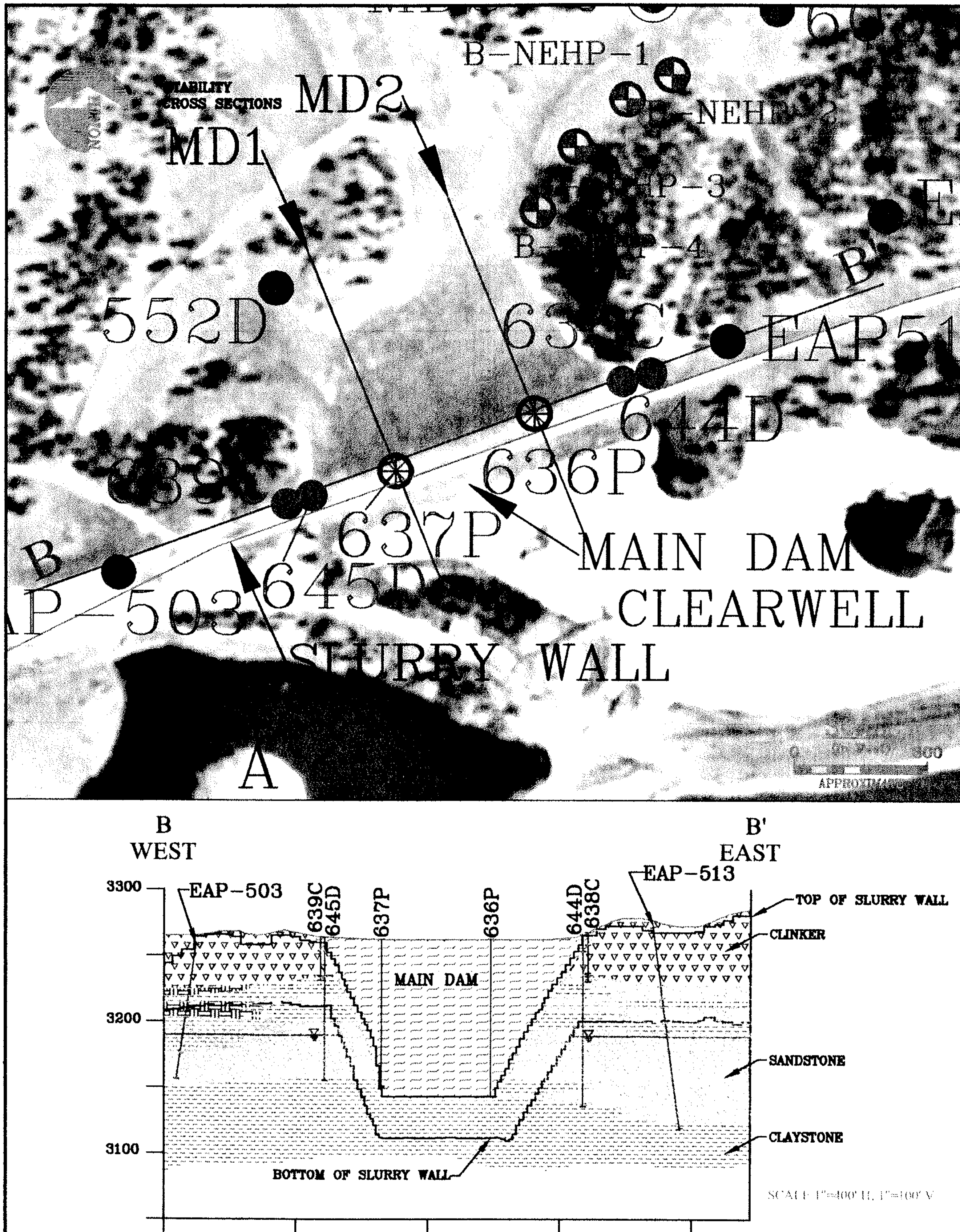
JOB No.	DRAWING No.	REV.
10676	C3-0736	3

34x44 "E" SIZE

EXHIBIT 6

Appendix A

Instrumentation



PPL, Montana, LLC Units 3&4 EHP Main Dam Stability Analysis	LOCATION MAP AND CROSS SECTION	FIGURE 1

UPDATE TIME:
\ \ \JRG \ \052909\\\Server\data\Clients\ppl\maindam_0507\MainDamStability.dwg

WOMACK & ASSOCIATES, INC.

UNITS 3&4 MAIN DAM ELECTRONIC PIEZOMETER AND CLEARWELL
TABLE 1: ELEVATION DATA, PPL MONTANA, LLC

DATE	636P (depth 119') field reading (v)	pore pressure (psi)	height of water above piezo (ft)	phreatic surface elevation (ft)	pore pressure ratio (r_u)	C cell el* (ft)	Old Clearwell el*, (ft)	Notes
2-Jun-01	0.278							0735 before installation
2-Jun-01	0.279							1245 before installation
2-Jun-01	0.279							1430 before installation
2-Jun-01	0.281	0.10	0.23	3144.23	0.00	3258.70	3216.0	1700 after installation
4-Jun-01	0.360	4.05	9.35	3153.35	0.04	3258.98	3126.0	time 1005
16-Dec-01	0.550	13.55	31.27	3175.27	0.12	3260.00	3224.5	
18-Dec-01	0.547	13.40	30.92	3174.92	0.12	3260.16	3224.1	time 0810
16-Jan-02	0.550	13.55	31.27	3175.27	0.12	3259.40	3226.1	time 1151
13-Mar-02	0.551	13.60	31.38	3175.38	0.12	3259.47	3228.3	
30-May-02	0.556	13.85	31.96	3175.96	0.12	3258.04	3223.1	
26-Jul-02	0.552	13.65	31.50	3175.50	0.12	3260.98	3222.3	
12-Apr-03	0.577	14.90	34.38	3178.38	0.13	3259.50	3230.9	time 0835
27-Apr-04	0.610	16.55	38.19	3182.19	0.15	3258.27	3224.8	time 1020
16-Dec-04	0.608	16.45	37.96	3181.96	0.15	3258.00	3222.9	time 0906
4-Oct-07	0.620	17.05	39.35	3183.35	0.15	3266.47	3238.7	time 1012

* Elevation from closest date.

Installed Depth (ft)	119.0
Ground El at Installation (ft)	3263.0
Transducer El ft)	3144.0

TABLE 1: PIEZOMETER DATA
PPL MAIN DAM 1311D2

DATE	636-P (depth 119') field reading (v)	pore pressure (psi)	height of water above piezo (ft)	pore pressure ratio (r_u)	Notes	637-P (depth 111') field reading (v)	pore pressure (psi)	height of water above piezo (ft)	pore pressure ratio (r_u)	Notes
31-May-01										
31-May-01						0.197				1400 before installation
1-Jun-01						0.196				1630 before installation
1-Jun-01						0.052				1200 before installation
1-Jun-01						0.202				1300 before installation
1-Jun-01						0.202				1315 before installation
1-Jun-01						0.520	15.90	36.69	0.15	1340 after installation
1-Jun-01						0.520	15.90	36.69	0.15	1430 after installation
2-Jun-01	0.278				0735 before installation	0.510	15.40	35.54	0.15	1730 after installation
2-Jun-01	0.279				1245 before installation	0.232	1.50	3.46	0.01	0730 after installation
2-Jun-01	0.279				1430 before installation					
2-Jun-01	0.281	0.10	0.23	0.00	1700 after installation					
4-Jun-01	0.360	4.05	9.35	0.04	time 1005					
16-Dec-01	0.550	13.55	31.27	0.12		0.352	7.50	17.31	0.07	time 1010
18-Dec-01	0.547	13.40	30.92	0.12	time 0810	0.051	-7.55	-17.42	-0.07	
						0.050	-7.60	-17.54	-0.07	time 0815

Colstrip 3&4 EHP Main Dam

Note: 638C & 639C are monitoring wells completed into the dam abutement down to the base of the clinker (baked shale)
Note: 644D & 645D are groundwater collection wells completed in deep foundation material, below the concrete cutoff wall
Note: 636P & 637P are piezometers

	638C	639C			644D	645D	636P	637P
BOH	3231.56	3230.60			3139.39	3156.73		
	elevation	elevation			elevation	elevation		
Jan-07	3235.08	dry	1	Jan-07	3163.37	3177.14		
Feb-07	3235.16	dry	2	Jan-07	3163.28	3177.27		
Mar-07	3236.21	dry	3	Jan-07	3162.67	3176.99		
Mar-07	3234.70	dry	4	Feb-07	3161.55	3176.48		
May-07	3236.71	dry	5	Feb-07	3162.24	3177.01		
Jun-07	3236.70	dry	6	Feb-07	3161.88	3176.72		
Jul-07	3236.05	dry	7	Mar-07	3161.01	3176.26		
Aug-07	3237.11	dry	8	Mar-07	3161.45	3176.67		
Sep-07	3239.11	dry	9	Mar-07	3160.91	3176.34		
Sep-07	3238.46	dry	10	Apr-07	3163.39	3188.73		
Oct-07	3238.11	dry	11	Apr-07	3153.62	3179.46		
Nov-07	3238.91	dry	12	Apr-07	3155.37	3178.24		
Dec-07	3237.96	dry	13	May-07	3160.43	3178.25		
Jan-08	3237.75	dry	14	May-07	3155.54	3178.08		
Feb-08	3237.98	dry	15	May-07	3144.87	3188.51		
Mar-08	3237.55	dry	16	Jun-07	3156.39	3179.37		
Mar-08	3237.31	dry	17	Jun-07	3154.46	3178.18		
Apr-08	3237.29	dry	18	Jun-07	3159.96	3177.93		
May-08	3235.96	dry	19	Jul-07	3152.53	3177.99		
May-08	3239.45	dry	20	Jul-07	3157.39	3177.94		
Jul-08	3238.77	dry	21	Jul-07	3155.39	3178.2		
Aug-08	3237.06	dry	22	Aug-07	3158.39	3178.4		
Sep-08	3234.25	dry	23	Aug-07	3158.39	3178.54		
Sep-08	3234.21	dry	24	Aug-07	3158.39	3178.44		
Oct-08	3233.62	dry	25	Sep-07	3158.84	3178.45		
Nov-08	3233.75	dry	26	Sep-07	3158.39	3178.61		
Dec-08	3235.52	dry	27	Sep-07	3159.51	3178.59		
Jan 09	3235.02	dry	28	Oct-07	3158.89	3178.66		
Feb 09	3235.84	3230.86	29	Oct-07	3154.25	3178.74		
Mar 09	3236.03	dry	30	Oct-07	3159.64	3178.83		
Apr 09	3236.68	dry	31	Nov-07	3159.39	3178.7		
May 09	3238.34	dry	32	Nov-07	3159.39	3178.67		
Jun 09	3237.53	dry	33	Nov-07	3159.39	3178.69		
			34	Dec-07	3159.52	3178.69		
			35	Dec-07	3159.39	3178.66		
			36	Dec-07	3159.39	3178.71		
			37	Jan-08	3154.09	3178.51		
			38	Jan-08	3154.15	3178.72		
			39	Jan-08	3155.30	3178.67		
			40	Feb-08	3161.53	3178.65		
			41	Feb-08	3156.55	3178.67		
			42	Feb-08	3154.36	3178.49		
			43	Mar-08	3153.97	3187.12		
			44	Mar-08	3149.45	3188.62		
			45	Mar-08	3160.01	3189.67		
			46	Apr-08	3156.58	3189.79		
			47	Apr-08	3161.15	3180.27		
			48	Apr-08	3160.55	3178.71		
			49	May-08	3160.29	3179.12		
			50	May-08	3159.12	3175.49		
			51	May-08	3162.69	3174.14		
			52	Jun-08	3143.68	3174.07		
			53	Jun-08	3154.61	3174.42		
			54	Jun-08	3154.50	3174.23		
			55	Jul-08	3158.22	3174.04		
			56	Jul-08	3154.30	3174.39		
			57	Aug-08	3190.24	3187.3		
			58	Aug-08	3189.23	3172.19		
			59	Sep-08	3185.77	3172.09		
			60	Sep-08	3189.47	3171.39		
			61	Sep-08	3189.42	3171.06		
			62	Oct-08	3178.79	3170.95		
			63	Oct-08	3189.39	3170.78		
			64	Oct-08	3185.90	3171.06		
			65	Nov-08	3151.79	3171.5		
			66	Nov-08	3185.39	3171.42		
			67	Dec-08	3151.42	3170.18		
			68	Dec-08	3184.83	3171.41		
			69	Jan 09	3155.10	3171.53		
			70	Feb 09	3156.43	3172.59		
			71	Mar 09	3151.88	3172.18		
			72	Apr 09	3142.08	3174.01		

Colstrip 3&4 EHP Saddle Dam

Note: SD-00-IC-01 thru 05 are inclinometers
Note: SD-00-P1 thru P21 are piezometers

	SD-00-P1	SD-00-P2	SD-00-P4	SD-00-P5	SD-00-P6	SD-00-P7	SD-00-P8	SD-00-P9	SD-00-P10	SD-00-P11	SD-00-P12	SD-00-P13	SD-00-P14	SD-00-P15	SD-00-P16	SD-00-P17	SD-00-P18	SD-00-P19	SD-00-P20	SD-00-P21
BOH	3216.60	3214.10	3214.30	3213.05	3213.66	3209.20	3214.82	3213.00	3212.64	3214.20	3213.90	3210.10	3211.60	3215.00	3217.23	3220.97	3218.60	3219.70	3212.10	3213.12
4/19/2006	3235.23	3235.26	3214.33	3213.74	3214.09	3213.30	3215.19	3213.95	3213.16	dry	dry	3214.64	3216.64	dry	3217.54	dry	3222.31	3221.93	3217.59	dry
6/20/2006	3234.61	3234.65	3214.32	3213.67	3214.05	3213.33	3215.19	3213.90	3213.07	dry	dry	3214.56	3216.52	dry	3217.77	dry	3222.32	3221.80	3217.48	dry
6/9/2008	3237.79	3237.84	3214.58	3214.55	3214.57	3214.20	dry	3214.65	3213.80	dry	dry	3215.20	3217.03	dry	3217.68	3222.79	3223.09	3223.22	3218.86	3213.62
10/20/2008	3236.96	3237.01	3214.43	3214.15	3214.17	3213.90	dry	3214.24	3213.47	dry	dry	3214.77	3216.65	dry	3217.66	3220.93	3222.83	3222.19	3217.87	3213.34
1/10/2009	3236.27	3236.33	3214.36	3213.82	3214.09	3213.74	3215.09	3213.98	3213.26	dry	dry	3214.57	3216.50	dry	3217.60	dry	3222.59	3222.09	3217.66	dry
2/3/2009	3236.22	3236.28	3214.38	3213.82	3214.10	3213.69	3215.09	3213.98	3213.24	dry	dry	3214.57	3216.50	dry	3217.61	3220.65	3222.56	3221.93	3217.66	3213.12
3/3/2009	3236.09	3236.16	3214.39	3213.81	3214.09	3213.70	3215.09	3213.96	3213.24	dry	dry	3214.57	3216.50	dry	3217.61	dry	3222.54	3221.93	3217.63	dry
4/3/2009	3236.07	3236.13	3214.38	3213.77	3214.08	3213.63	3215.08	3213.93	3213.18	dry	dry	3214.54	3216.49	dry	3217.61	dry	3222.50	3221.88	3217.59	dry
5/4/2009	3236.07	3236.13	3214.38	3213.76	3214.08	3213.60	3215.09	3213.92	3213.16	dry	dry	3214.54	3216.49	dry	3217.60	3220.58	3222.47	3221.86	3217.57	dry
6/2/2009	3235.76	3235.82	3214.37	3213.72	3214.08	3213.58	3215.08	3213.89	3213.13	dry	dry	3214.53	3216.47	dry	3217.60	dry	3222.42	3221.74	3217.53	dry

Water Levels - surveyed.

EPA copy.

Date	B Pond Elev	A Pond Elev	STEP A Cell Elev	C Pond North Elev	C Pond South Elev	STEP B Cell Elev	STEP E Cell Elev	STEP CW Elev	EHP A Cell Elev	EHP B Cell Elev	EHP C Cell Elev	EHP F Cell Elev	EHP G Cell Elev	EHP Old CW Elev	EHP New CW Elev
1/8/2009	3259.5	3253.30	3260.09	3260.34	3264.35	3252.83	3256.69	3256.69	3259.13	3279.63	3271.88	3286.1	3234.63	3235.03	3286
1/16/2009	3260.5	3253.50	3260.09	3260.34	3264.40	3252.83	3256.5	3256.5	3259.13	3279.63	3271.39	3286.2	3235.49	3237.39	3286
1/23/2009	3258.5	3253.50	3260.09	3260.34	3264.38	3252.83	3257.08	3257.08	3259.13	3279.63	3271.86	3286.2	3235.09	3236.4	3286
1/29/2009	3259.5	3253.47	3260.09	3260.43	3264.83	3252.83	3256.87	3256.87	3259.13	3279.63	3272.17	3286.3	3234.42	3235.56	3286
2/5/2009	3259.9	3253.51	3260.09	3260.34	3264.36	3252.83	3256.98	3256.98	3259.13	3279.63	3271.74	3286.1	3234.52	3237.19	3286.12
2/11/2009	3259.2	3253.79	3260.09	3260.24	3264.09	3252.83	3257.24	3257.24	3259.13	3279.63	3272.38	3286.1	3234.55	3235.81	3285.97
2/19/2009	3260.1	3253.89	3260.09	3260.29	3264.06	3252.83	3257.17	3257.17	3259.13	3279.63	3272.29	3286.1	3234.92	3235.81	3285.97
2/25/2009	3259.3	3253.74	3260.09	3260.09	3264.16	3252.83	3257.56	3257.56	3259.13	3279.63	3272.02	3286.2	3234.83	3236.84	3285.97
3/5/2009	3260.2	3253.92	3260.09	3260.16	3263.98	3253.17	3257.6	3257.6	3259.13	3279.63	3271.98	3286.34	3234.81	3237.03	3285.97
3/12/2009	3259.2	3253.92	3260.09	3260.36	3264.12	3253.17	3258.12	3258.12	3259.13	3279.63	3272.32	3286.34	3234.24	3235.16	3285.97
3/19/2009	3259	3254.10	3260.09	3260.18	3264.08	3253.51	3257.55	3257.55	3259.13	3279.63	3272.23	3286.5	3234.57	3236.47	3286.03
3/26/2009	3260.4	3254.04	3260.09	3260.22	3264.02	3253.51	3257.72	3257.72	3259.13	3279.63	3272.32	3286.5	3234.54	3236.3	3286.03
4/2/2009	3259.3	3255.16	3260.09	3260.20	3264.03	3253.51	3258.4	3258.4	3259.13	3279.63	3272.27	3286.6	3234.71	3237.11	3286.03
4/9/2009	3258.94	3255.97	3260.09	3260.16	3264.01	3253.2	3258.64	3258.64	3259.13	3279.63	3272.63	3286.66	3234.73	3235.62	3286.19
4/16/2009	3259.6	3256.54	3260.09	3260.26	3264.01	3253.2	3258.2	3258.2	3259.13	3279.63	3272.92	3286.8	3235.03	3236.29	3285.7
4/23/2009	3259.5	3256.74	3260.09	3260.13	3263.85	3253.08	3258.63	3258.63	3259.13	3279.63	3272.15	3287.4	3234.9	3238.57	3285.07
4/30/2009	3260.1	3257.12	3260.09	3260.10	3263.76	3253.08	3258.53	3258.53	3259.13	3279.63	3271.45	3288	3234.84	3238.84	3285.27
5/6/2009	3259.1	3257.50	3260.09	3260.09	3263.78	3253.33	3258.68	3258.68	3259.13	3279.63	3271.51	3288	3234.97	3238.74	3285.11
5/14/2009	3258.5	3257.51	3260.09	3260.16	3263.69	3254.58	3258.21	3258.21	3259.13	3279.63	3271.72	3288	3234.62	3238.69	3285.84
5/21/2009	3259.5	3257.36	3260.09	3259.98	3264.28	3255.51	3257.34	3257.34	3259.13	3279.63	3271.74	3287.9	3234.83	3238.23	3286.68
5/28/2009	3259.7	3257.52	3260.09	3259.91	3264.26	3256.5	3257.62	3257.62	3259.13	3279.63	3271.59	3288	3234.49	3237.93	3287.09

Appendix B

Inspection Checklists

June 2 and 3, 2009

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: PPL MONTANA, COLSTRIP POWER PLANT Date: JUNE 2, 2009

Unit Name: UNITS 1 & 2 BOTTOM ASH POND Operator's Name: PPL MONTANA

Unit I.D.: Hazard Potential Classification: High Significant Low

Inspector's Name: STEPHEN G. BROWN.

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

DAM CREST EL. 3265

	Yes	No
1. Frequency of Company's Dam Inspections? QUARTERLY	✓	
2. Pool elevation (operator records)? El. 3261	✓	
3. Decant inlet elevation (operator records)? El. 3261	✓	
4. Open channel spillway elevation (operator records)?		✓
5. Lowest dam crest elevation (operator records)? 3265	✓	
6. If instrumentation is present, are readings recorded (operator records)?	N/A.	
7. Is the embankment currently under construction?		✓
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		✓
9. Trees growing on embankment? (If so, indicate largest diameter below)		
10. Cracks or scarps on crest?		✓
11. Is there significant settlement along the crest?		✓
12. Are decant trashracks clear and in place?	N/A	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓
14. Clogged spillways, groin or diversion ditches?		✓
15. Are spillway or ditch linings deteriorated?	✓	
16. Are outlets of decant or underdrains blocked?		✓
17. Cracks or scarps on slopes?		✓

	Yes	No
18. Sloughing or bulging on slopes?		✓
19. Major erosion or slope deterioration?		✓
20. Decant Pipes:		
Is water entering inlet, but not exiting outlet?		✓
Is water exiting outlet, but not entering inlet?		✓
Is water exiting outlet flowing clear?	✓	
21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
From underdrain?		✓
At isolated points on embankment slopes?	✓	
At natural hillside in the embankment area?		✓
Over widespread areas?		✓
From downstream foundation area?		✓
"Boils" beneath stream or ponded water?		✓
Around the outside of the decant pipe?		✓
22. Surface movements in valley bottom or on hillside?		✓
23. Water against downstream toe?		✓
24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
15.	STORMWATER DITCH AT DOWNSTREAM TOE HAS BURIED 2" PIPES FROM COLLECTION WELLS - POOR/LOOSE BACKFILL AROUND PIPES. SHOULD BE GRADED TO DRAIN
18.	OVERSTEEP SLOPES DUE TO PIPE TRENCH CUT AT DOWNSTREAM TOE. NO EVIDENCE OF SLOPE MOVEMENT.
21.	PONDED WATER AT DOWNSTREAM TOE OF EAST DIKE. SEEPAGE APPEARS TO ORIGINATE FROM OPEN BOX CULVERT THAT PENETRATES THE DIKE CREST AND SERVES AS CARRIER FOR PUMP DISCHARGE PIPES (NO LONGER IN SERVICE). PPL PLANS TO REMOVE BOX CULVERT AND PIPES AND BACKFILL.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NONE ACTIVE; ZERO DISCHARGE FACILITY. INSPECTOR STEPHEN BROWN-
Date JUNE 2, 2009

Impoundment Name UNITS 1 & 2 BOTTOM ASH PONDS
Impoundment Company PPL MONTANA
EPA Region 8
State Agency (Field Office) Addresss MONTANA DEQ. 1520 E. SIXTH AVE, HELENA, MT 59620
Name of Impoundment UNITS 1 & 2 BOTTOM ASH PONDS
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ✓ Update ____

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: EAST PORTION – BOTTOM ASH SETTLING POND
WEST PORTION – CLEAR WATER (DECANT WATER)

Nearest Downstream Town : Name COLSTRIP
Distance from the impoundment 0.25 MILE, OR LESS
Impoundment
Location: Longitude 45 Degrees ~~25~~ 52 Minutes 53 Seconds
Latitude 106 Degrees 37 Minutes 7.5 Seconds
State MT County ROSEBUD

Does a state agency regulate this impoundment? YES ____ NO X

If So Which State Agency? MONTANA DAM SAFETY DIVISION DOES NOT REGULATE THE IMPOUNDMENT.

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

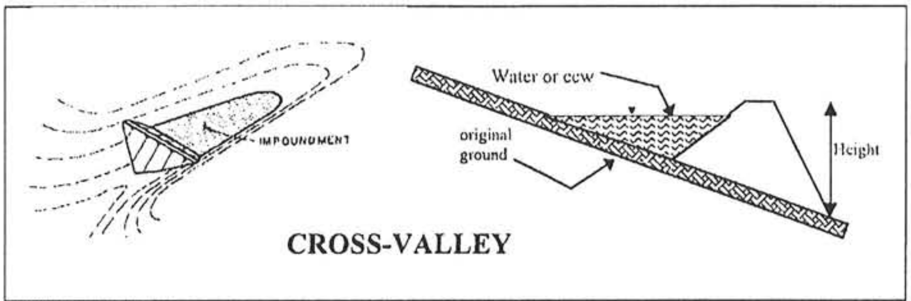
_✓_ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

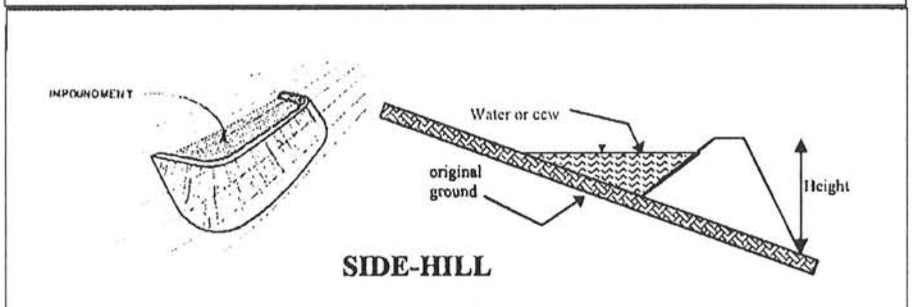
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

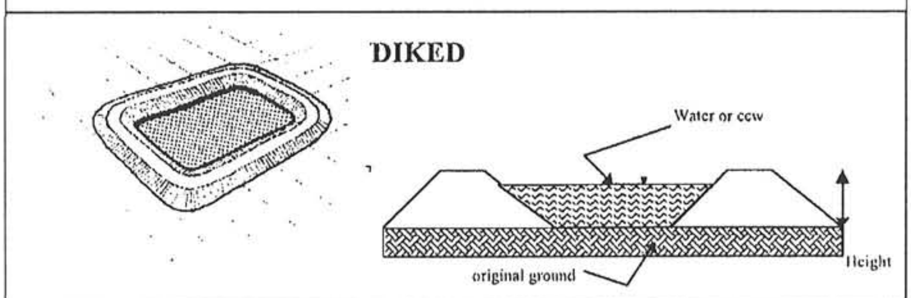
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

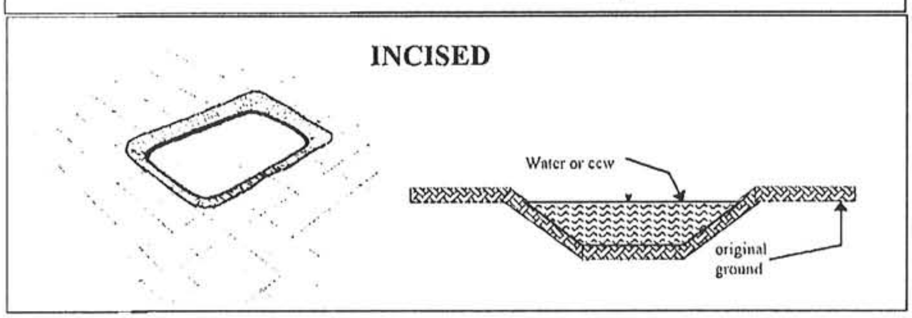
HAZARD CLASS ASSIGNED BY PPL DUE TO PROXIMITY OF ARMELLS CREEK AND THE TOWN OF COLSTRIP. POTENTIAL FOR SIGNIFICANT ECONOMIC/ENVIRONMENTAL DAMAGE. APPEARS TO BE LOW POTENTIAL FOR LOSS OF LIFE, THOUGH AN INUNDATION STUDY WOULD BE REQUIRED TO DETERMINE IF HIGH HAZARD WOULD BE APPROPRIATE.

CONFIGURATION:









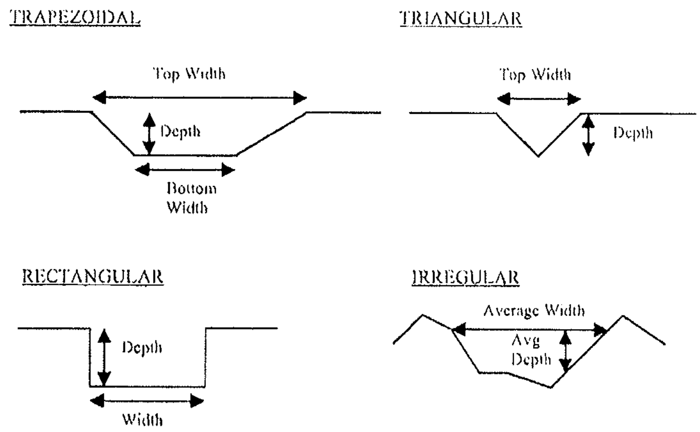
_____ Cross-Valley
_____ Side-Hill
✓ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 25 feet   Embankment Material Silty Clay & Silt
Pool Area 7 acres   Liner Double 45-mil RFP MEMBRANE w/LCS
Current Freeboard 4 feet   Liner Permeability 1×10^{-9} cm/sec ±

TYPE OF OUTLET (Mark all that apply)

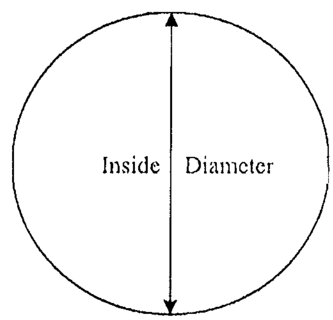
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width



_____ **Outlet**

_____ inside diameter



Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES _______ NO _______

✓ **No Outlet**

_____ **Other Type of Outlet** (specify) ________________________________

The Impoundment was Designed By BECHTEL CORP. 1988

Has there ever been a failure at this site? YES ________ NO ✓

If So When? ____________________

If So Please Describe : ____________________

Has there ever been significant seepages at this site? YES ✓ NO ______

If So When? JUNE 2009

IF So Please Describe: Observed during assessment. Ponded water at downstream toe of east dike. Seepage appears to occur through box culvert that penetrates ~~dike~~ just below the dike crest. Box culvert enables discharge pipes to exit the pond. PPL was made aware of the condition and plans to remove box culvert and pipes (out of service) and backfill.
Seepage flow through box culvert can vary depending on pond elevation and any wave action - seepage could vary from a trickle to significant with potential to erode the loose, erodable soil that comprises the embankment shell.
Observed seepage flow was a trickle.

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________ NO ✓

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____________________

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: PPL MONTANA, COLSTRIP	Date: JUNE 2, 2009
Unit Name: Units 1 & 2 "A" POND.	Operator's Name: PPL MONTANA.
Unit I.D.:	Hazard Potential Classification: High **Significant** Low
Inspector's Name: STEPHEN G. BROWN.	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

DAM CREST EL. 3264

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections? Quarterly	✓		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)? El. 3257.5	✓		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)? El. 3260	✓		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)? 3264	✓		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)?	N/A		Is water exiting outlet flowing clear?		✓
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		✓	From underdrain?		✓
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?	✓		22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?		✓	23. Water against downstream toe?		✓
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # | Comments

15. STORMWATER DITCH AT DOWNSTREAM TOE HAS BURIED 2" PIPES FROM collection WELLS - BACKFILL AROUND PIPES HAS BEEN ERODED AND COULD PRESENT SEEPAGE PATH.

18. SLOPE OVERSTEEPENED DUE TO PIPE TRENCH CUT AT DOWNSTREAM TOE. NO EVIDENCE OF SLOPE MOVEMENT.

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

__✓__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

HAZARD CLASS ASSIGNED BY PPL DUE TO PROXIMITY OF ARNELL'S CREEK AND TOWN OF COLSTRIP. POTENTIAL FOR SIGNIFICANT ECONOMIC/ENVIRONMENTAL DAMAGE. APPEARS TO BE LOW POTENTIAL FOR LOSS OF LIFE BASED ON POND CAPACITY BEING RELATIVELY SMALL AT 245 AC-FT, HOWEVER AN INUNDATION STUDY WOULD BE REQUIRED TO DETERMINE IF HIGH HAZARD CLASSIFICATION WOULD BE APPROPRIATE.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NONE ACTIVE; ZERO DISCHARGE FACILITY INSPECTOR STEPHEN G. BROWN GEI CONSULTANTS
Date June 2, 2009.

Impoundment Name UNITS 1 & 2 "A" POND
Impoundment Company PPL MONTANA
EPA Region 8
State Agency (Field Office) Addresss MONTANA DEQ. 1520 E. SIXTH AVE, HELENA, MT 59620
Name of Impoundment UNITS 1 & 2 "A" POND.
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ✓ Update ______

	Yes	No
Is impoundment currently under construction?		✓
Is water or ccw currently being pumped into the impoundment?	✓	

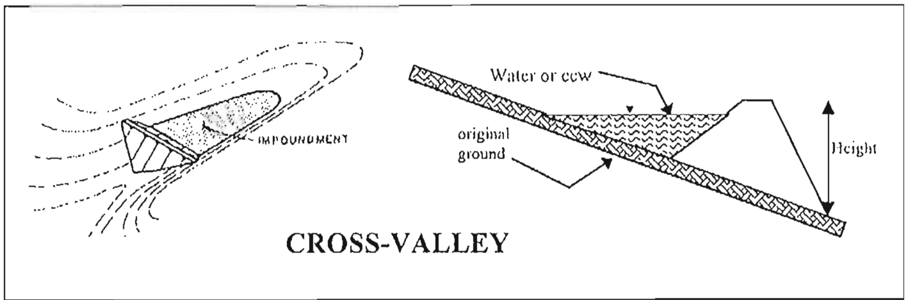
IMPOUNDMENT FUNCTION: FLY ASH STORAGE UNTIL 2005 - NOW A STORMWATER RUNOFF POND.

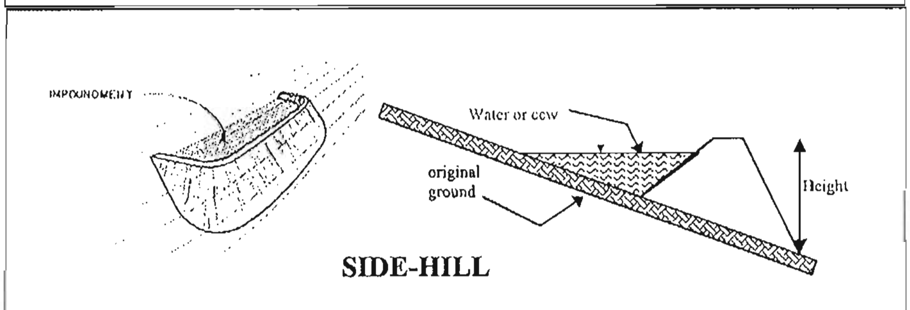
Nearest Downstream Town : Name COLSTRIP
Distance from the impoundment 0.25 MILE, OR LESS
Impoundment
Location: Longitude 45 Degrees 52 Minutes 45 Seconds
Latitude 106 Degrees 37 Minutes 8 Seconds
State MT County ROSEBUD

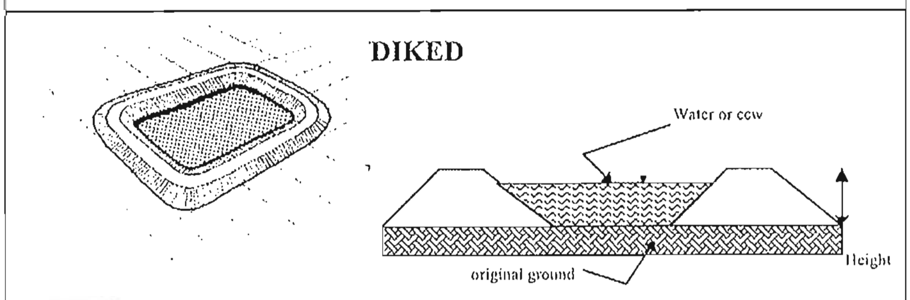
Does a state agency regulate this impoundment? YES ______ NO ✓

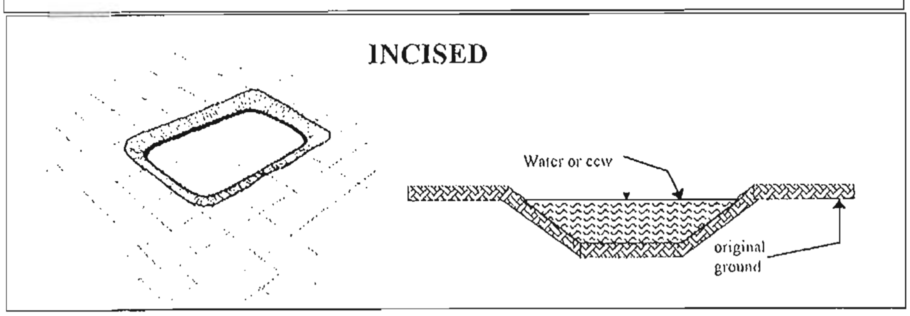
If So Which State Agency? MONTANA DAM SAFETY DIVISION DOES NOT REGULATE THE IMPOUNDMENT.

CONFIGURATION:









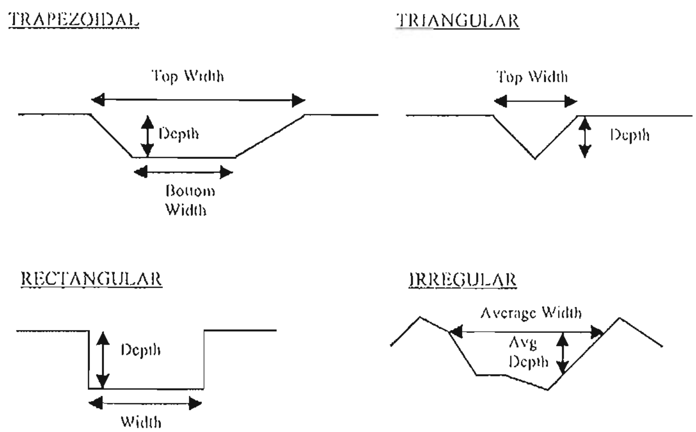
_____ Cross-Valley
_____ Side-Hill
__✓__ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height ___25___ feet   Embankment Material _silty clay & silt_
Pool Area ___14___ acres   Liner _None_
Current Freeboard ___6.5___ feet   Liner Permeability _— N/A._

TYPE OF OUTLET (Mark all that apply)

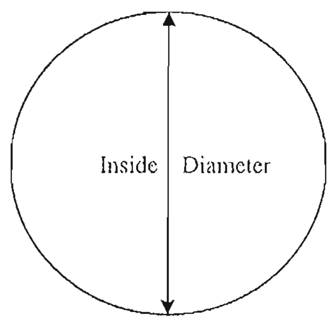
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width



_____ **Outlet**

_____ inside diameter



Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES _______ NO _______

_X_ **No Outlet** WATER IS REMOVED BY PUMPING.

_____ **Other Type of Outlet** (specify) ________________________________

The Impoundment was Designed By BECHTEL CORP. 1988; MODIFIED IN 2005 BY HKM ENGINEERING, INC.

Has there ever been a failure at this site? YES __________ NO ___✓___

If So When? ______________________

If So Please Describe : ______________________

Has there ever been significant seepages at this site? YES _______ NO ✓

If So When? ____________________

IF So Please Describe: ____________________

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________ NO ✓

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____________________

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: PPL MONTANA Colstrip Power Plant	Date: June 3, 2009.
Unit Name: UNITS 1 & 2 STAGE TWO EVAPORATION POND (STEP)	Operator's Name: PPL MONTANA
Unit I.D.:	Hazard Potential Classification: High Significant Low
Inspector's Name: STEPHEN BROWN, GEI CONSULTANTS, INC.	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

DAM CREST EL. 3278

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections? QUARTERLY	✓		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)? El. 3258	✓		19. Major erosion or slope deterioration?		✓
3 Decant inlet elevation (operator records)?	N/A		20. Decant Pipes: N/A		
4. Open channel spillway elevation (operator records)?	✓ El. ~~3276~~ 3274.5		Is water entering inlet, but not exiting outlet?		
5. Lowest dam crest elevation (~~operator records~~)? EST.	✓ El. 3266±		Is water exiting outlet, but not entering inlet?		
6. If instrumentation is present, are readings recorded (operator records)?	✓		Is water exiting outlet flowing clear?		
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	✓		From underdrain?		✓
9 Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes? *	✓	
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?	N/A	
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?	N/A		23. Water against downstream toe?		✓
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
#21.	SEEPS RESULTING FROM SYNTHETIC MEMBRANE LINING TEARS HAVE BEEN CONTAINED WITHIN A CELL, OR BETWEEN CELLS, AND HAVE NOT INVOLVED SEEPAGE THROUGH THE MAIN DAM. LINING INSTALLATION METHODS WERE MODIFIED TO AVOID FUTURE TEARS RESULTING FROM THERMAL EXPANSION & CONTRACTION.

U. S. Environmental Protection Agency

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NO ACTIVE PERMIT; ZERO DISCHARGE FACILITY INSPECTOR STEPHEN BROWN GEI CONSULTANTS, INC.

Date JUNE 3, 2009.

Impoundment Name UNITS 1 & 2 STAGE TWO EVAPORATION PONDS (STEP)

Impoundment Company PPL MONTANA

EPA Region 8

State Agency (Field Office) Addresss MONTANA DEPT OF ENVIRONMENTAL QUALITY 1520 E. SIXTH AVE, HELENA, MT 59620

Name of Impoundment UNITS 1 & 2 STEP

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ✓ Update ______

	Yes	No
Is impoundment currently under construction?		✓
Is water or ccw currently being pumped into the impoundment?	✓	

IMPOUNDMENT FUNCTION: ______

Nearest Downstream Town : Name COLSTRIP

Distance from the impoundment 0.5 MILE

Impoundment Location:

Longitude 45 Degrees 54 Minutes 19.8 Seconds

Latitude 106 Degrees 38 Minutes 39.2 Seconds

State MT County ROSEBUD

Does a state agency regulate this impoundment? YES ______ NO ✓

If So Which State Agency? MONTANA DAM SAFETY DIVISION DOES NOT REGULATE THE IMPOUNDMENT.

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

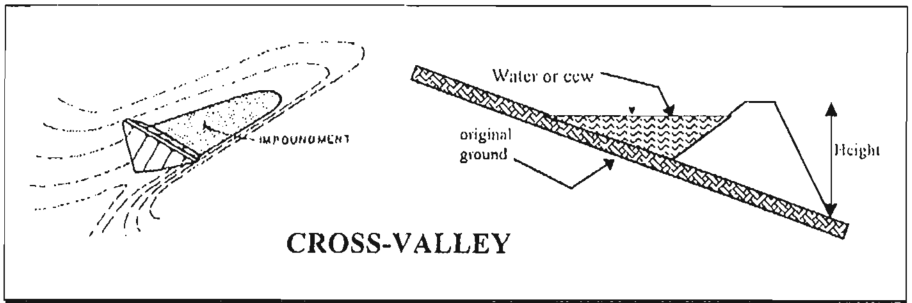
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

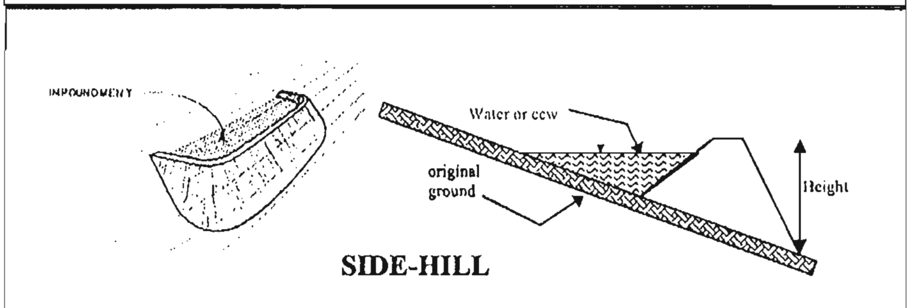
_✓_ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

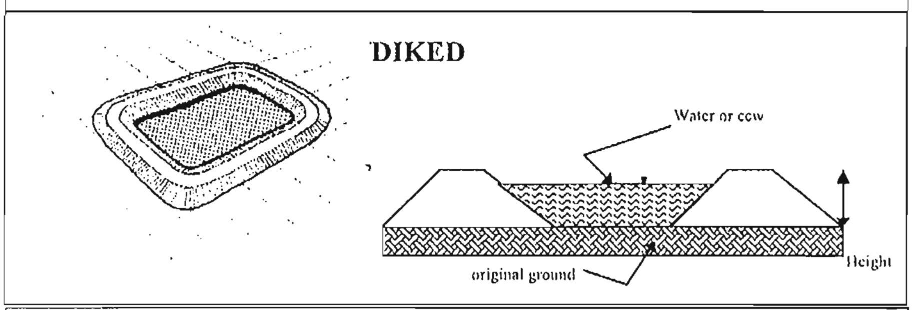
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

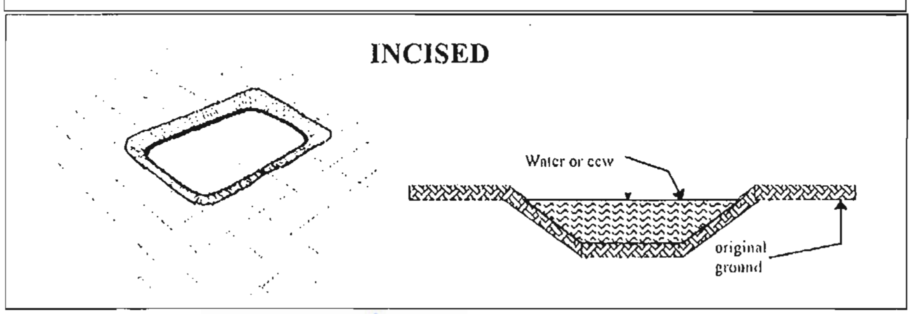
CLOSE PROXIMITY OF ABOUT 0.5 MILE TO RESIDENTIAL AREA DOWN-STREAM OF DAM THAT IS WITHIN MAPPED INUNDATION AREA INDICATES PROBABLE LOSS OF LIFE WOULD OCCUR WITH CATASTROPHIC FAILURE OF DAM.

CONFIGURATION:









_✓_ Cross-Valley / DIKED COMBINATION
_____ Side-Hill
_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

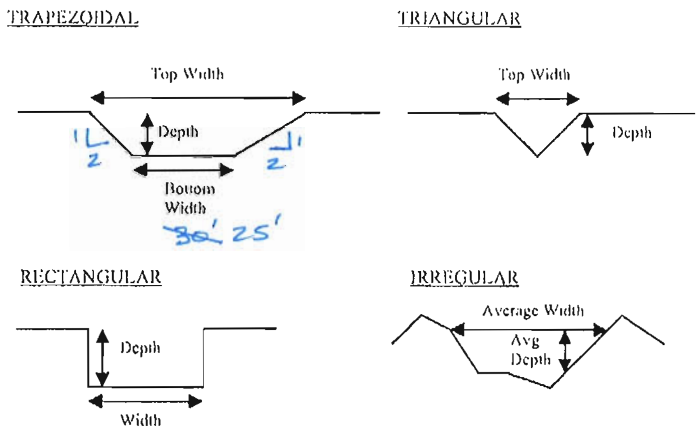
Embankment Height _88_ feet Embankment Material _SILTY CLAY CORE; SILT & SAND SHELLS.
Pool Area _176_ acres Liner _HDPE MEMBRANE *_
Current Freeboard _20_ feet Liner Permeability _1×10^{-9} cm/sec ±_

* SINGLE HDPE IN 3 CELLS, DOUBLE HDPE MEMBRANE (REINF. POLYETHYLENE) IN CELL "B". 100mil thick HDPE.

TYPE OF OUTLET (Mark all that apply)

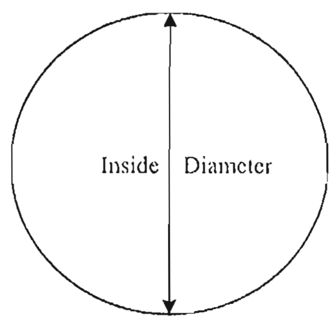
✓ **Open Channel Spillway**
✓ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

14' depth (MAX)
25' bottom (or average) width
80' top width ±



_____ **Outlet**

_____ inside diameter



Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES _______ NO _______

✓ **No Outlet**

_____ **Other Type of Outlet** (specify) ______________________________

The Impoundment was Designed By BECHTEL CORP. 1989

Has there ever been a failure at this site? YES __________ NO ✓__________

If So When? ____________________________

If So Please Describe : ____________________________

Has there ever been significant seepages at this site? YES ✓ NO ______

If So When? 1991 & 2006

IF So Please Describe: NO RELEASE OF CCW. IN 1991 THE HDPE LINING TORE DUE TO THERMAL EXPANSION/CONTRACTION SOON AFTER BEING PUT IN SERVICE. LEAK WAS CONTAINED BY DIKES/DAM AND WAS CLEANED UP. COMPENSATION WAS ADDED TO LINING FOR THERMAL.

IN 2006, THE PUMP BARGE TORE HDPE LINING. SIMILAR TO 1991 THIS WAS CLEANED UP & BARGE "DOCK" LOCATION IMPROVED TO AVOID FUTURE TEARS.

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ______ NO ✓

If so, which method (e.g., piezometers, gw pumping,...)? ______

If so Please Describe : ______

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: PPL MONTANA, COLSTRIP Date: JUNE 3, 2009

Unit Name: UNITS 3 & 4 EFFLUENT HOLDING POND [EHP] Operator's Name: PPL MONTANA

Unit I.D.: Hazard Potential Classification: High Significant Low — Assessment — PPL Inundation Study.

Inspector's Name: STEPHEN BROWN, GEI CONSULTANTS, INC.

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

DAM CREST EL. 3262

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections? Quarterly	✓		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)? EL. 3237 OLD CLEARWELL	✓		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)? (*)	N/A		20. Decant Pipes: N/A		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		
5. Lowest dam crest elevation (operator records)? 3262	✓		Is water exiting outlet, but not entering inlet?		
6. If instrumentation is present, are readings recorded (operator records)?	✓		Is water exiting outlet flowing clear?		
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	✓		From underdrain?		✓
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest? (*)	✓		At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest? (*)	✓		Over widespread areas?		✓
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area? (*)	✓	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?	N/A	
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?	N/A		23. Water against downstream toe?		✓
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # — Comments

(3) No decant inlet or pipes

(10) Cracks on Saddle Dam only due to seepage event 1999

(11) Several inches on Saddle Dam due to seepage event 1999; Likely internal erosion

(21) Seepage across embankment dam/cement-bentonite cutoff wall contact in Saddle Dam in 1999; seepage flowed through permeable rock zone "clinker" Rosebud Fm. and daylighted about 100 yd downstream. Repairs have not been made to Saddle Dam. Management controls implemented to not raise reservoir above El. 3237 in "G" cell and are changing operations to store 'paste' and not free water in "G" cell.

(15) Spillway designed but not constructed

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NONE ACTIVE; ZERO DISCHARGE FACILITY. INSPECTOR STEPHEN BROWN GEI CONSULTANTS, INC.
Date JUNE 3, 2009

Impoundment Name UNITS 3 & 4 EFFLUENT HOLDING POND
Impoundment Company PPL MONTANA, COLSTRIP
EPA Region 8
State Agency (Field Office) Addresss MONTANA DEPT. OF ENVIRONMENTAL QUALITY 1520 E Sixth Ave, HELENA, MT 59620
Name of Impoundment UNITS 3 & 4 EFFLUENT HOLDING POND
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ✓ Update ______

	Yes	No
Is impoundment currently under construction?		✓ (DESIGN OF 28' DAM RAISE IN PROGRESS)
Is water or ccw currently being pumped into the impoundment?	✓	

IMPOUNDMENT FUNCTION: CONTAIN CCW PRODUCTS

Nearest Downstream Town : Name FARM RESIDENCES IN COW CREEK
Distance from the impoundment 8 MILES
Impoundment Location: N 45° 52' 13" W 106° 32' 53.6"
Longitude 45 Degrees 52 Minutes 13 Seconds
Latitude 106 Degrees 32 Minutes 53.6 Seconds
State MT County ROSEBUD

Does a state agency regulate this impoundment? YES ______ NO ✓

If So Which State Agency? MONTANA DAM SAFETY DIVISION DOES NOT REGULATE THE IMPOUNDMENT

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

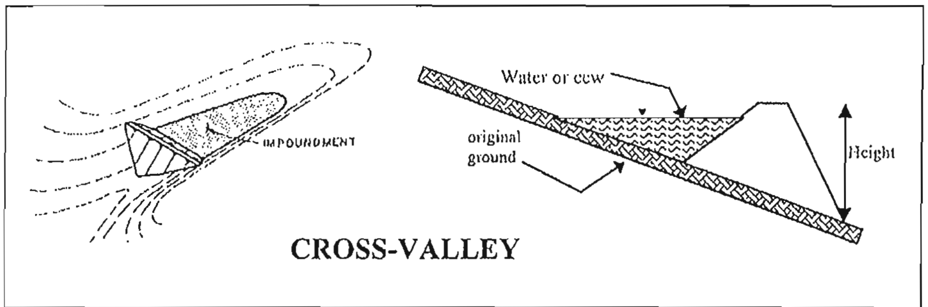
_✓_ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

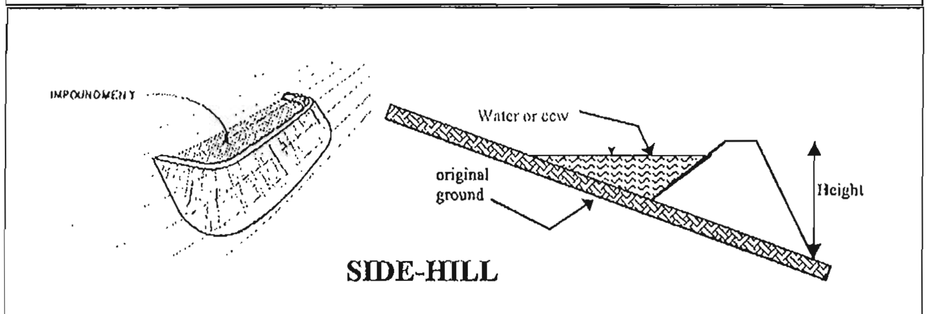
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

UNIT WAS DESCRIBED AS LOW HAZARD IN 104(e) RESPONSE. ASSESSMENT SUGGESTS AT LEAST SIGNIFICANT HAZARD DUE TO POTENTIAL ENVIRONMENTAL AND ECONOMIC DAMAGE TO CLEAN UP/REMEDIATE CCW FROM DOWNSTREAM FLOOD PLAIN. UNIT COULD POTENTIALLY BE HIGH HAZARD BASED ON ISOLATED RESIDENCES IN FLOODPLAIN AT 8 MILES DOWNSTREAM AND POTENTIAL FLOODING OF COUNTY ROADS.

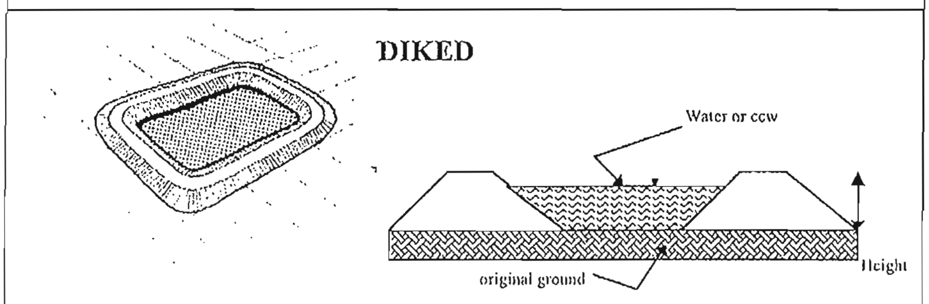
CONFIGURATION:



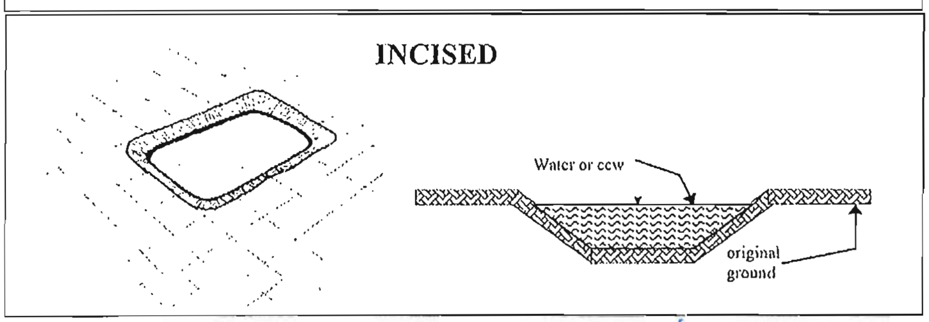
CROSS-VALLEY



SIDE-HILL



DIKED



INCISED

__✓__ Cross-Valley/DIKED COMBINATION; MAIN DAM & SADDLE DAM
______ Side-Hill
______ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

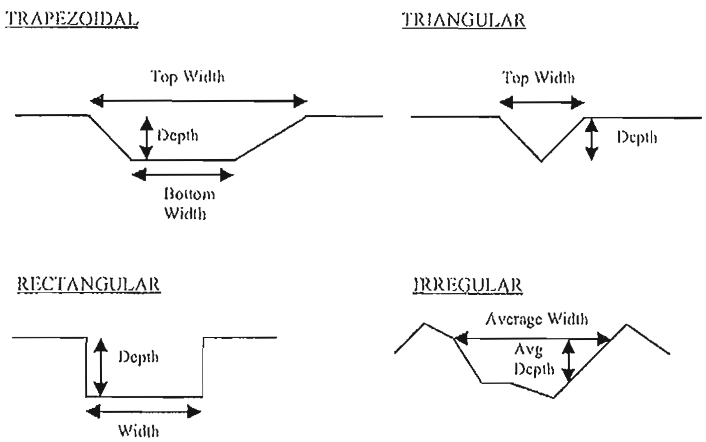
Embankment Height ___138___ feet   Embankment Material SILT AND LOW-PLASTICITY CLAY
Pool Area ___367___ acres   Liner INITIALLY NONE: CURRENTLY SEVERAL CELLS
Current Freeboard ___25___ feet   Liner Permeability HAVE RFP MEMBRANE LINER

RFP - REINFORCED POLYETHYLENE -
- PERMEABILITY 1×10^{-9} cm/sec ±

TYPE OF OUTLET (Mark all that apply)

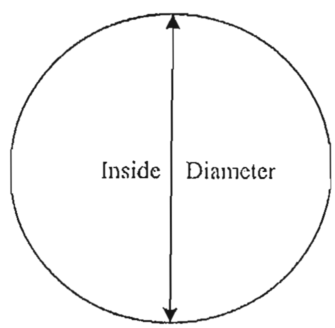
N/A **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width



N/A **Outlet**

_____ inside diameter



Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES _______ NO _______

✓ **No Outlet**

_____ **Other Type of Outlet** (specify) ______________________________

The Impoundment was Designed By BECHTEL CORP., 1984

Has there ever been a failure at this site? YES ________ NO ✓

If So When? ____________________

If So Please Describe : NO SIGNIFICANT RELEASE OF CCW. THERE HAVE BEEN SEEPAGE ISSUES.

Has there ever been significant seepages at this site? YES ✓ NO ______

If So When? 1999, DECEMBER

IF So Please Describe: DURING INITIAL FILLING OF CELL "G" WITH SLURRIED FLY ASH (15% SOLIDS) A SEEP WAS OBSERVED AT A LOCATION ABOUT 100 YARDS DOWNSTREAM OF DAM (SADDLE DAM). SEEP OCCURRED THROUGH BURNED SHALE OF ROSEBUD FM. WHEN RESERVOIR ~~WAS~~ REACHED APPROX. EL. 3241. SEEP OCCURRED THROUGH EAST SADDLE DAM – SEEPAGE PATHWAY IS THOUGHT TO BE THROUGH THE CONTACT BETWEEN CONCRETE CUTOFF WALL AND OVERLYING DAM CORE OR THROUGH A JOINT IN CONCRETE CUTOFF WALL. SEEPAGE RESULTED IN DIFFERENTIAL SETTLEMENT AND CRACKING OF PORTIONS OF SADDLE DAM, AS OBSERVED ON DAM CREST.

NO REPAIRS HAVE BEEN MADE TO SADDLE DAM. HOWEVER, THE UTILITY QUICKLY LOWERED THE RESERVOIR POOL IN RESPONSE TO THE OBSERVED SEEP. AT ABOUT POOL EL. 3237, THE SEEPAGE WAS REDUCED (THIS EL CORRESPONDS TO NEAR BOTTOM OF THE BAKED SHALE). UTILITY HAS IMPLEMENTED MANAGEMENT CONTROLS TO MAINTAIN CELL "G" POOL BELOW EL. 3237 AND HAS BEGUN REPLACING STORED WATER WITH FLY-ASH "PASTE", WHICH IS ABOUT 70% SOLIDS AND HAS HIGH STRENGTH DUE TO CEMENT BONDS. WATER LEVELS IN POOL "G" ARE MANAGED BY NOT DIRECTING PIPED FLOWS INTO THE POND AND BY SUPPLEMENTING EVAPORATION WITH PUMPING, AS NEEDED. FREEBOARD IS ABOUT 25 FT WITH THE POOL AT EL. 3237.

Oct. 2004 – SEEP THROUGH CUTOFF WALL (NO DAM IN THIS AREA) THAT FLOWED TO SOUTH FROM EHP. SEEP WAS THROUGH NATURAL ROCK RESERVOIR RIM. OPEN ~~COLD~~ JOINT IN CONC CUTOFF WALL SUSPECTED.

Feb. 2005 – SEEP THROUGH CUTOFF WALL (NO DAM IN THIS AREA) THAT FLOWED TO WEST FROM EHP. MANAGEMENT CONTROLS IMPLEMENTED TO NOT STORE 2 FT OF EVAPORATION WATER ON TOP OF CLOSED FLY ASH CELL. OPEN ~~COLD~~ JOINT IN CONC CUTOFF WALL SUSPECTED.

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ✓ NO ________

If so, which method (e.g., piezometers, gw pumping,...)? RESERVOIR POOL PUMPED OUT

If so Please Describe : SEE PREVIOUS PAGE DESCRIBING SEEPAGE ISSUE IN 1999 AND UTILITIES RESPONSE TO LOWER THE RESERVOIR AND MAINTAIN IT AT A LOW LEVEL IN CELL "G" ADJACENT TO THE EAST SADDLE DAM.

Appendix C

Inspection Photographs

June 2 and 3, 2009

Photo 1: Units 1 & 2 Bottom Ash Ponds: west cell, general view looking northeast from southwest corner of pond.

Photo 2: Units 1 & 2 Bottom Ash Ponds: east cell, looking west. The east cell has a clay lining. Note the out-of-service pump barge and associated pipes.

Photo 3: Units 1 & 2 Bottom Ash Ponds: west cell, looking north at crest of west embankment. Note RFP lining on upstream slope.

Photo 4: Units 1 & 2 Bottom Ash Ponds: east cell, looking south at crest of east embankment.

Photo 5: Units 1 & 2 Bottom Ash Ponds: west cell, looking northwest corner of pond upstream slope.

Photo 6: Units 1 & 2 Bottom Ash Ponds: east cell, looking east along upstream slope. Note fly ash pushed up against the upstream slope.

Photo 7: Units 1 & 2 Bottom Ash Ponds: looking north at carrier pipe penetration of RFP lining near southwest corner of pond and upstream slope. Note carrier pipe end is not sealed and would allow seepage directly to embankment at higher pond levels.

Photo 8: Units 1 & 2 Bottom Ash Ponds: east cell, looking north along downstream toe from near the southwest corner of east cell. Note disturbed soil at toe along recent pipe trench.

Photo 9: Units 1 & 2 Bottom Ash Ponds: west cell, rodent holes in downstream slope near northwest corner of west cell.

Photo 10: Units 1 & 2 Bottom Ash Ponds: west cell, view of over-steepened slope at downstream toe near northwest corner, most likely caused by excavation for pipe alignment adjacent to toe.

Photo 11: Units 1 & 2 Bottom Ash Ponds: west cell, view of settlement holes near northwest corner caused by poor compaction of pipe trench backfill. Similar holes were found along the entire toe of the Bottom Ash and "A" Pond embankments.

Photo 12: Units 1 & 2 Bottom Ash Ponds: west cell, view of out-of-service manhole at northwest corner. Manhole is about 20 feet deep.

Photo 13: Units 1 & 2 Bottom Ash Ponds: east cell, view of ponded seepage water at downstream toe near northeast corner of east cell. Seepage results from flow through box culvert that penetrates embankment crest.

Photo 14: Units 1 & 2 “A” Pond: General view of pond from north embankment, looking south.

Photo 15: Units 1 & 2 “A” Pond: View from northwest corner, looking south at upstream slope and crest of clay lined pond.

Photo 16: Units 1 & 2 “A” Pond: looking south at upstream slope of west embankment. Note minor vegetation.

Photo 17: Units 1 & 2 “A” Pond: looking north at downstream toe and slope of west embankment. Note disturbed soil of pipe trench backfill along toe.

Photo 18: Units 1 & 2 STEP Dam: looking along upstream slope from near the right abutment. Note cell D has not been put in service. At right abutment looking northwest – upstream slope

Photo 19: Units 1 & 2 STEP Dam – looking to right (southeast) at dam crest. Note the upstream cell at right (cell D) has not been put in service.

Photo 20: Units 1 & 2 STEP Dam – upstream slope at clearwell, looking to left. Note RFP liner.

Photo 21: Units 1 & 2 STEP Dam – upstream slope at clearwell, looking to right. Note RFP liner in good condition and slope appears uniform and regular.

Photo 22: Units 1 & 2 STEP Dam: erosion on upstream slope due to surface water run-on near groin at right abutment.

Photo 23: Units 1 & 2 STEP Dam: downstream slope, looking to the right from mid-height near the center of the dam.

Photo 24: Units 1 & 2 STEP Dam: downstream toe, looking to the right from near the center of the dam.

Photo 25: Units 1 & 2 STEP Dam: erosion in groin near right downstream groin caused by stormwater runoff from a drainage area located to the right of the dam.

Photo 26: Units 1 & 2 STEP Dam: Emergency spillway, looking downstream.

Photo 27: Units 3 & 4 EHP Main Dam: View of very wide dam crest from left abutment, looking to the right. The Old Clearwell cell is on the upstream side.

Photo 28: Units 3 & 4 Main Dam: Fill in topographic low area (saddle) located about 500 feet to the left of left abutment. This fill may constitute part of the Main Dam, but has not been documented as such.

Photo 29: Units 3 & 4 Main Dam: Looking to right from the left abutment – upstream slope with soil cement protection that impounds the Old Clearwell.

Photo 30: Units 1 & 4 Main Dam: Looking to left from the right abutment – upstream slope with soil-cement.

Photo 31: Units 3 & 4 Main Dam: seepage at left abutment on upstream face. Seep is above the reservoir elevation and apparently originates from perched water in adjacent divider berm or in abutment.

Photo 32: Units 3 & 4 Main Dam: Looking to right at the downstream slope from left abutment.

Photo 33: Units 3 & 4 Main Dam: Looking to left at downstream slope and toe from the right groin area.

Photo 34: Units 3 & 4 Main Dam: Drain sand exposed by rodent activity in right groin drain system.

Photo 35: Units 3 & 4 Main dam: Minor surface erosion at about mid-height on downstream slope near left groin.

Photo 36: Units 3 & 4 Saddle Dam: View of very wide dam crest from the left abutment, looking to the right. Cell "G" is impounded to the right.

Photo 37: Units 3 & 4 Saddle Dam: Upstream side of upstream crest at right abutment. Note heavy sage brush vegetation.

Photo 38: Units 3 & 4 Saddle Dam: Healed/infilled cracks on crest (originally observed in association with the 1999 seepage event). Cracks are aligned with the upstream side of the concrete cutoff wall.

Photo 39: Units 3 & 4 Saddle Dam: Healed/infilled crack on crest (originally observed in 1999 – up to 1 foot wide and several feet deep).

Photo 40: Units 3 & 4 Saddle Dam: View of upstream slope from near the left abutment. Note soil-cement erosion protection.

Photo 41: Units 3 & 4 Saddle Dam: Upstream face near mid-point along dam length and near intersection with “G” cell divider dike. Note minor vegetation on soil cement.

Photo 42: Units 3 & 4 Saddle Dam: View of downstream slope looking to the right.

Photo 43: Units 3 & 4 Saddle Dam: Downstream toe near left abutment.

Photo 44: Units 3 & 4 Saddle Dam: Test pit excavated in 1999 that has not been backfilled. Granular drain material and broken toe drain pipe was exposed in the test pit.

Photo 45: Units 3 & 4 Saddle Dam: Close-up view of drain sand and drain pipe in test pit.

Photo 46: Units 3 & 4 Saddle Dam: Surface erosion near crest at left abutment/downstream groin.

Photo 47: Units 3 & 4 Saddle Dam: Looking directly downstream at location where the 1999 seepage day-lighted near base of the rock hill. The bare ground marks the seepage location, which is about 100 yards downstream of the dam toe.

Appendix D

Reply to Request for Information Under Section 104(e)

Neil J. Dennehy
Manager, Fossil Generation Assets
Tel. 406.748.5066 Fax 406 748.5000
njdennehy@pplweb.com

PPL Montana, LLC
Colstrip Steam Electric Station
PO Box 38
580 Willow Avenue
Colstrip, MT 59323

PPL Montana, LLC

March 26, 2009

Mr. Richard Kinch
US Environmental Protection Agency
Two Potomac Yard
2733 S. Crystal Dr.
5th Floor; N-5783
Arlington, VA 22202 2733

RE: Request for Information under Section 104 (e) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9604(e)

Dear Mr. Kinch:

PPL Montana LLC's Colstrip Steam Electric Station received the EPA's Information Collection Request (ICR) on coal combustion residues (CCR) surface impoundments on March 13, 2009. Attached is PPL Montana's response to the ICR and the associated signed certification statement.

While this facility only has two disposal impoundments for CCRs, we have included other smaller impoundments that received waste waters that have or may have contacted CCRs as was indicated in clarifications on the ICR provided to the Utility Solid Waste Activities Group (USWAG).

The Colstrip impoundments are regulated in Montana under the Major Facility Siting Act. Montana also has a Dam Safety Rule, but it does not regulate the Colstrip impoundments. Since 1988, the Colstrip station has elected to follow the intent of the Montana Dam Safety Rule and has had Dam Safety Inspections conducted by a dam safety engineer approximately every five years.

If you have any questions or need additional information, please contact Craig Shamory from our Environmental Management Department at 610-774-5653 or csshamory@pplweb.com.

Sincerely,

Neil Dennehy

CC: Craig Shamory PPL, EMD
Gordon Criswell PPLM

ICR Letter Certification Statement:

I certify that the information contained in this response to EPA's request for information and any accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: ______________________

Name: Neil Dennehy

Title: Mgr Fossil Generation Assets, Colstrip Steam Electric Station

PPL response to ICR

Plant Name: Colstrip
Impoundment Name: Units 1&2 Stage Two Evaporation Pond (STEP)

Please provide the information requested below for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material for the storage or disposal of residuals or by-products form the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. This includes units that no longer receive coal combustion or by-products, but still contain free liquid.

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

   In 2005, Maxim Technologies, a division of Tetra Tech, Inc. conducted a Phase I inspection of this impoundment and followed the Corps of Engineers' guidelines to rate this dam. Based upon height, the dam is classified as an intermediate sized dam.

   Within a short distance downstream of the dam, development includes residences, businesses, a primary state highway, and a railroad. Sudden failure of this structure would likely result in extensive property damage and a high potential for loss of lives. This project is therefore assigned a high hazard potential.

   The regulatory agency for this unit is the Montana Department of Environmental Quality.

2. What year was the management unit commissioned and expanded?

   The STEP pond was commissioned in 1992. In 2006, the B cell section of this unit was double-lined with 45-mil RFP and leachate collection installed.

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash; (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other", please specify the other types of materials that are temporarily or permanently contained in the unit(s).

   Flyash, bottom ash, boiler slag, and flue gas emission control residuals are permanently contained in this unit.
   Other type materials stored in this pond include mill rejects.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?
   This unit was designed by a professional engineer and the construction of the unit was under supervision of a professional engineer. Inspection and monitoring of the safety of the unit is also under the supervision of a professional engineer.

5. When did the company last assess or evaluate the safety (structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

   The company last evaluated the safety of the unit in 2005. Dam safety inspections began in 1988 and been conducted about every five years since then. The dam safety inspections have been conducted by Maxim Technologies, a division of Tetra Tech, Inc. The inspection was conducted by a professional engineer and reviewed by a professional engineer from Maxim Technologies.
   As a result of the 2005 inspection, the following actions were completed:

   - repair the cracks, sinkholes, and minor erosion developing directly over the return line from the valley drain sump to the dam crest
   - repair rill erosion gullies at a pipeline valve on the upstream slope adjoining D cell
   - restrict vehicles from spillway area and provide better vegetation
   - backfill and compact rodent holes
   - initiate a rodent control plan

- continue monthly monitoring of water levels in observation wells and hour meter on the valley drain sump and have that information reviewed by hydrogeology consulting firm Hydrometrics

Corrective actions were taken as directed by the plant environmental engineering group and involved earth moving contractors, pest control contractors, and a hydrogeology consulting firm.

The next dam safety inspection is scheduled for 2009.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

   There has not been a safety inspection from a State or Federal regulatory official, but by a contracted dam safety engineer.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

   Not applicable.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

   The STEP has a surface area of 176 acres and a total storage capacity of 4370 acre-feet. As of September 2006, the unit was estimated at 45% full of material. The maximum height of the unit is 88 feet.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

   10/11/99 – a small water spill was observed at the D cell concrete outlet structure. This spill (~100 gallons) was contained within 10 feet of the outlet structure within the boundary of the pond, captured and returned to the pond. This spill was reported to the Montana Department of Environmental Quality.

8/29/00 – a small water spill was observed at the C cell concrete outlet structure. This spill (~50 gallons) was contained within 10 feet of the outlet structure within the boundary of the pond, captured and returned to the pond. This spill was reported to the Montana Department of Environmental Quality.

2/1/06 – a water spill was observed on the C cell dike. A small hole (~1 inch in diameter) in the HDPE liner was found just below the water level and water flowed through the upper portion of the dike where it exited through a rodent hole. The pond was lowered and the spill was stopped. The liner was repaired. The spill (~2000 gallons) moved about 100 feet to the toe of the dike and was captured in a temporary lined sump and returned to the pond. The spill was contained within the pond boundary.

10. Please identify all current legal owner(s) and operator(s) at the facility.

PPL Montana, LLC – Owner/Operator
Puget Sound Energy, Inc. – Owner

PPL response to ICR

Plant Name: Colstrip
Impoundment Name: Units 1&2 A Pond

Please provide the information requested below for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material for the storage or disposal of residuals or by-products form the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. This includes units that no longer receive coal combustion or by-products, but still contain free liquid.

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

   About half of this unit is incised, with the west side of the pond extending above the ground surface. While the drainage in this area is on the plant site, it is adjacent to Armells Creek and the town of Colstrip with possible loss of human life and likely significant property damage and environmental destruction. The height of this unit is 25 feet and the capacity of the unit is 245 acre-feet. Based on this information, the 1&2 A Pond is assigned a significant hazard classification. This pond will be part of the 2009 Dam Safety inspection since part of it sits above the natural ground level. That inspection will be conducted by Maxim Technologies, a division of Tetra Tech, Inc.

   The regulatory agency for this unit is the Montana Department of Environmental Quality.

2. What year was the management unit commissioned and expanded?

   The Units 1&2 A Pond was commissioned in 1975. Originally, this pond was part of the Units 1&2 Flyash Pond, but in 2005, it was removed from service as a flyash pond and converted to a clean water **storage** pond (stormwater runoff, etc.).

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash; (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other", please specify the other types of materials that are temporarily or permanently contained in the unit(s).

   There is a small amount of flyash and flue gas emission control residuals left in this pond that have been covered with a geocomposite clay blanket and bottom ash. The other types of materials it now receives include dirt and coal from storm water runoff.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

   This unit was designed by a professional engineer and the construction of the unit was under supervision of a professional engineer. Monitoring of the safety of the unit is also under the supervision of a plant professional engineer.

5. When did the company last assess or evaluate the safety (structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

   An assessment of the safety (structural integrity) of this unit has not been completed since original design and construction. In 2009, this unit will be part of the dam safety inspection conducted by Maxim Technologies. This inspection will be conducted by a professional engineer and reviewed by a professional engineer.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

   There has not been a safety inspection from a State or Federal regulatory official.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

   Not applicable.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

   The 1&2 A Pond has a surface area of 14 acres and a total storage capacity of 245 acre-feet. The volume of materials currently stored in the unit is about 10% of the storage capacity. The maximum height of the unit is 25 feet.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

   3/18/03 – A spill of ~2700 gallons of water flowed through an abandoned pipe and settled at the base of the dike on plant property. This water was captured and returned to the pond and the abandoned pipe was permanently plugged. This spill was reported to the Montana Department of Environmental Quality.

10. Please identify all current legal owner(s) and operator(s) at the facility.

    PPL Montana, LLC – Owner/Operator
    Puget Sound Energy, Inc. – Owner

PPL response to ICR

Plant Name: Colstrip
Impoundment Name: Units 1&2 B Flyash Pond

Please provide the information requested below for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material for the storage or disposal of residuals or by-products form the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. This includes units that no longer receive coal combustion or by-products, but still contain free liquid.

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

   This unit is incised (completely below grade) and does not have a dam, so it has been assigned a Less-than-Low hazard rating.

   The regulatory agency for this unit is the Montana Department of Environmental Quality.

2. What year was the management unit commissioned and expanded?

   The Units 1&2 B Flyash Pond was commissioned in 1975. In 2004, this unit was converted to a double-lined 45-mil RFP pond with leachate collection.

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash: (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other", please specify the other types of materials that are temporarily or permanently contained in the unit(s).

   Flyash and flue gas emission control residuals are periodically sent to this unit when the STEP is not available. Other types of materials like plant floor drains, and coal system washdown is also contained in this unit. This material is temporarily stored at this unit and every 5 – 10 years it is sent to the 1&2 STEP for final deposition.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

   This unit was designed by a professional engineer and the construction of the unit was under supervision of a professional engineer. Monitoring of the safety of the unit is also under the supervision of a plant professional engineer.

5. When did the company last assess or evaluate the safety (structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

   An assessment of the safety (structural integrity) of this unit has not been completed since original design and construction

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

   There has not been a safety inspection from a State or Federal regulatory official.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

   Not applicable.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

   The 1&2 B Flyash Pond has a surface area of 10 acres and a total storage capacity of 196 acre-feet. This unit is a temporary storage location for flyash, flue gas emission control residuals and the volume of materials is ~25% of the unit's capacity. The maximum height of the unit is 25 feet.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

   There have been no releases from this unit within the last ten years.

10. Please identify all current legal owner(s) and operator(s) at the facility.

    PPL Montana, LLC – Owner/Operator
    Puget Sound Energy, Inc. – Owner

PPL response to ICR

Plant Name: Colstrip
Impoundment Name: Units 1&2 Bottom Ash Pond

Please provide the information requested below for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material for the storage or disposal of residuals or by-products form the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. This includes units that no longer receive coal combustion or by-products, but still contain free liquid.

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

   About half of this unit is incised, but the north and west sides of the pond do extend above the ground surface. While the drainage in this area is on the plant site, it is adjacent to Armells Creek and the town of Colstrip with possible loss of human life and likely significant property damage and environmental destruction. The height of this unit is 25 feet and the capacity of the unit is 73 acre-feet. Based on this information, the 1&2 Bottom Ash Pond is assigned a significant hazard classification. This pond will be part of the 2009 Dam Safety inspection since part of it sits above the natural ground level. That inspection will be conducted by Maxim Technologies, a division of Tetra Tech, Inc.

   The regulatory agency for this unit is the Montana Department of Environmental Quality.

2. What year was the management unit commissioned and expanded?

   The Units 1&2 Bottom Ash Pond was commissioned in 1988.

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash; (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other", please specify the other types of materials that are temporarily or permanently contained in the unit(s).

   Bottom ash and boiler slag are temporarily contained in this unit. Other materials that are temporarily contained in this unit include mill rejects. The final deposition of materials from this unit is normally the 3&4 EHP.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

   This unit was designed by a professional engineer and the construction of the unit was under supervision of a professional engineer. Monitoring of the safety of the unit is also under the supervision of a plant professional engineer.

5. When did the company last assess or evaluate the safety (structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

   An assessment of the safety (structural integrity) of this unit has not been completed since original design and construction. In 2009, this unit will be part of the dam safety inspection conducted by Maxim Technologies. This inspection will be conducted by a professional engineer and reviewed by a professional engineer.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

   There has not been a safety inspection from a State or Federal regulatory official.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

   Not applicable.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

   The 1&2 Bottom Ash Pond has a surface area of 7 acres and a total storage capacity of 73 acre-feet. This unit is a temporary storage location for bottom ash, with the bottom ash being removed to its final location on a weekly basis. The maximum height of the unit is 25 feet.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

   There have been no releases from this unit within the last ten years.

10. Please identify all current legal owner(s) and operator(s) at the facility.

    PPL Montana, LLC – Owner/Operator
    Puget Sound Energy, Inc. – Owner

PPL response to ICR

Plant Name: Colstrip
Impoundment Name: Units 1&2 C Pond

Please provide the information requested below for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material for the storage or disposal of residuals or by-products form the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. This includes units that no longer receive coal combustion or by-products, but still contain free liquid.

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

   The majority of this unit is incised, but does contain one corner (northwest) that extends above the ground surface. The drainage in this area is on the plant site toward a laydown area, with no probable loss of human life and low economic and environmental losses. The height of the southwest corner is 14 feet and the capacity of the unit is 400 acre-feet. Based on this information, the 1&2 C Pond is assigned a low hazard classification. This pond will be part of the 2009 Dam Safety inspection since part of it sits above the natural ground level. That inspection will be conducted by Maxim Technologies, a division of Tetra Tech, Inc.

   The regulatory agency for this unit is the Montana Department of Environmental Quality.

2. What year was the management unit commissioned and expanded?

   The Units 1&2 C Pond was commissioned in 1978. Originally, this pond was used as a cooling tower blowdown pond, and in 1987 it was divided into 2 sections. Since 2005, this pond is used to store raw water and storm water runoff from A pond. Water from this pond is used for road dust control.

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash; (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other", please specify the other types of materials that are temporarily or permanently contained in the unit(s).

   Other materials that are contained in this pond are cooling tower blowdown and water from the 1&2 A Pond. This pond is included in this survey because it gets water from the 1&2 A Pond which had in the past received flyash and flue gas emission control residuals.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

   This unit was designed by a professional engineer and the construction of the unit was under supervision of a professional engineer. Monitoring of the safety of the unit is also under the supervision of a plant professional engineer.

5. When did the company last assess or evaluate the safety (structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

   An assessment of the safety (structural integrity) of this unit has not been completed since original design and construction. In 2009, this unit will be part of the dam safety inspection conducted by Maxim Technologies. This inspection will be conducted by a professional engineer and reviewed by a professional engineer.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

   There has not been a safety (structural integrity) inspection from a State or Federal regulatory official.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

   Not applicable.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

   The 1&2 C Pond has a surface area of 20.5 acres and a total storage capacity of 400 acre-feet. The volume of materials currently stored in the unit is about 10% of the storage capacity. The maximum height of the unit is 14 feet.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

   There have been no releases from this unit within the last ten years.

10. Please identify all current legal owner(s) and operator(s) at the facility.

    PPL Montana, LLC – Owner/Operator
    Puget Sound Energy, Inc. – Owner

PPL response to ICR

Plant Name: Colstrip
Impoundment Name: Units 3&4 Effluent Holding Pond (EHP)

Please provide the information requested below for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material for the storage or disposal of residuals or by-products form the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. This includes units that no longer receive coal combustion or by-products, but still contain free liquid.

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

   In 2005, Maxim Technologies, a division of Tetra Tech, Inc. conducted a Phase I inspection of this impoundment and followed the Corps of Engineers' guidelines to rate this dam. Based upon height, the main dam is classified as a large sized dam and the saddle dam is classified as an intermediate sized dam.

   The area downstream from the dams is a combination of rural, range land, and agricultural land. The nearest structure is located about eight miles away. Sudden failure of this structure would dissipate in the relatively broad, flat drainage valleys of Cow Creek and Rosebud Creek. Damage to private and county roads is expected to be minimal and slow flooding of isolated farm buildings and residences is possible, but the potential for loss of life appears to be low. This project is therefore assigned a low hazard potential.

   The regulatory agency for this unit is the Montana Department of Environmental Quality.

2. What year was the management unit commissioned and expanded?

   The EHP pond was commissioned in 1983.

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash; (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other", please specify the other types of materials that are temporarily or permanently contained in the unit(s).

   Flyash, bottom ash, boiler slag, and flue gas emission control residuals are permanently contained in this unit.
   Other types of materials stored in this unit include plant floor drains, cooling tower blowdown, demineralizer neutralization sump discharge, mill rejects, and periodic boiler waterside chemical cleaning solution.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

   This unit was designed by a professional engineer and the construction of the unit was under supervision of a professional engineer. Inspection and monitoring of the safety of the unit is also under the supervision of a professional engineer.

5. When did the company last assess or evaluate the safety (structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

   The company last evaluated the safety of the unit in 2005. Dam safety inspections began in 1988 and been conducted about every five years since then. The dam safety inspections have been conducted by Maxim Technologies, a division of Tetra Tech, Inc. The inspection was conducted by a professional engineer and reviewed by a professional engineer from Maxim Technologies.

   As a result of the 2005 inspection, the following actions were completed:

   - repair erosion damage to the groins and abutments of the Saddle Dam.
   - remediate and monitor the seepage from the hillside in the natural ground opposite the toe of the main dam
   - continue to monitor cracks, slope movement, monitoring wells on the crest of the Saddle Dam. This data was reviewed annually by a consultant (Womack Associates) familiar with dam design.
   - backfilled and compacted rodent holes
   - initiated a rodent control plan
   - continued monthly monitoring of water levels in observation wells and hour meter on the valley drain sump and had that information reviewed by hydrogeology consulting firm Hydrometrics
   - repair gully erosion in the left downstream groin of the Main Dam. Place rock where necessary and revegetate where possible.

   Corrective actions were taken as directed by the plant environmental engineering group and involved earth moving contractors, pest control contractors, and a hydrogeology consulting firm.

   The next dam safety inspection is scheduled for 2009.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

   There has not been a safety inspection from a State or Federal regulatory official, but by a contracted dam safety engineer.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

   Not applicable.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

   The EHP has a surface area of 367 acres and a total storage capacity of 17000 acre-feet. As of April 2005, the unit was estimated at 55% full of material. The maximum height of the unit is 138 feet.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

   12/21/99 – Water from the pond escaped underground and surfaced on the hillside just downgradient of the Saddle Dam. Surface water moved about 100 yards before it was captured in the Saddle Dam Valley Drain collection system and returned to the EHP. All spilled water (~1 million gallons) was contained on plant property and captured within ~100 yards of the Saddle Dam. This spill was reported to the Montana Department of Environmental Quality.

   9/28/04 – Water from the pond escaped underground and surfaced on the hillside south of the EHP. Surface water moved about 300 yards before it was captured behind a berm and returned to the EHP. All spilled water (~9 million gallons) occurred on land currently owned by the plant. This spill was reported to the Montana Department of Environmental Quality.

   1/25/05 – Water from the pond escaped underground and surfaced on the hillside west of the EHP. This spill is related to the 9/28/04 incident, only in a different area. Surface water moved about 100 yards before it was captured behind a berm and returned to the EHP. All spilled water (~4.5 million gallons) occurred on land currently owned by the plant. This spill was reported to the Montana Department of Environmental Quality.

10. Please identify all current legal owner(s) and operator(s) at the facility.

PPL Montana, LLC – Owner/Operator
Avista Corporation – Owner
NorthWestern Energy – Owner
Pacificorp Energy – Owner
Portland General Electric - Owner
Puget Sound Energy, Inc. – Owner

PPL response to ICR

Plant Name: Colstrip
Impoundment Name: Units 3&4 Bottom Ash Pond

Please provide the information requested below for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material for the storage or disposal of residuals or by-products form the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. This includes units that no longer receive coal combustion or by-products, but still contain free liquid.

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

   The majority of this unit is incised, but does contain one corner (southwest) that extends above the ground surface. The drainage in this area is on the plant site toward a laydown area, with no probable loss of human life and low economic and environmental losses. The height of the southwest corner is 14 feet and the capacity of the unit is 38.4 acre-feet. Based on this information, the 3&4 Bottom Ash Pond is assigned a low hazard classification. This pond will be part of the 2009 Dam Safety inspection since part of it sits above the natural ground level. That inspection will be conducted by Maxim Technologies, a division of Tetra Tech, Inc.

   The regulatory agency for this unit is the Montana Department of Environmental Quality.

2. What year was the management unit commissioned and expanded?

   The 3&4 Bottom Ash Pond was commissioned in 1983.

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash: (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other", please specify the other types of materials that are temporarily or permanently contained in the unit(s).

   Bottom ash and boiler slag are temporarily contained in this unit. Other types of materials stored in this unit include plant floor drains, demineralizer neutralization sump discharge, and mill rejects. The final deposition of materials from this unit is the 3&4 EHP.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

   This unit was designed by a professional engineer and the construction of the unit was under supervision of a professional engineer. Monitoring of the structural integrity of the unit is also under the supervision of a plant professional engineer.

5. When did the company last assess or evaluate the safety (structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

   An assessment of the safety (structural integrity) of this unit has not been completed since original design and construction. In 2009, this unit will be part of the dam safety inspection conducted by Maxim Technologies. This inspection will be conducted by a professional engineer and reviewed by a professional engineer.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

   There has not been a safety (structural integrity) inspection from a State or Federal regulatory official.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

   Not applicable.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

   The 3&4 Bottom Ash Pond has a surface area of 7.6 acres and a total storage capacity of 38.4 acre-feet. This unit is a temporary storage location for bottom ash, with the bottom ash being removed to its final location on a weekly basis. The maximum height of the unit is 14 feet.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

   There have been no releases from this unit within the last ten years.

10. Please identify all current legal owner(s) and operator(s) at the facility.

    PPL Montana, LLC – Owner/Operator
    Avista Corporation – Owner
    NorthWestern Energy – Owner
    Pacificorp Energy – Owner
    Portland General Electric - Owner
    Puget Sound Energy, Inc. – Owner

PPL response to ICR

Plant Name: Colstrip
Impoundment Name: Units 3&4 Scrubber Drain Collection Pond

Please provide the information requested below for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material for the storage or disposal of residuals or by-products form the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. This includes units that no longer receive coal combustion or by-products, but still contain free liquid.

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

   This unit is incised (completely below grade) and does not have a dam, so it has been assigned a Less-than-Low hazard rating.

   The regulatory agency for this unit is the Montana Department of Environmental Quality.

2. What year was the management unit commissioned and expanded?

   The Units 3&4 Scrubber Drain Collection Pond was commissioned in 1983. This unit was removed from service in 1999 and no longer receives scrubber water.

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash: (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other", please specify the other types of materials that are temporarily or permanently contained in the unit(s).

   Flyash and flue gas emission control residuals were periodically sent to this unit as it provided water to the scrubber building flush and drain system. There is a small amount of scrubber residue left in this unit.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

   This unit was designed by a professional engineer and the construction of the unit was under supervision of a professional engineer. Monitoring of the safety of the unit was also under the supervision of a plant professional engineer.

5. When did the company last assess or evaluate the safety (structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

   An assessment of the safety (structural integrity) of this unit has not been completed since original design and construction

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

   There has not been a safety inspection from a State or Federal regulatory official.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

   Not applicable.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

   The 3&4 Scrubber Drain Collection Pond has a surface area of 6 acres and a total storage capacity of 72 acre-feet. This unit is no longer in service, but it contains a small amount of flyash and flue gas emission control residuals. The volume of those materials is estimated at <10% of the unit's capacity.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

   There have been no releases from this unit within the last ten years.

10. Please identify all current legal owner(s) and operator(s) at the facility.

    PPL Montana, LLC – Owner/Operator
    Avista Corporation – Owner
    NorthWestern Energy – Owner
    Pacificorp Energy – Owner
    Portland General Electric - Owner
    Puget Sound Energy, Inc. – Owner

PPL response to ICR

Plant Name: Colstrip
Impoundment Name: Units 3&4 Scrubber Wash Tray Pond

Please provide the information requested below for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material for the storage or disposal of residuals or by-products form the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. This includes units that no longer receive coal combustion or by-products, but still contain free liquid.

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

   This majority of this unit is incised (completely below grade), but the northwest bank does contain a small dike about 10 feet in height. This unit is assigned a low hazard rating since it is no longer in service and does not contain scrubber water. The small amount of solids remaining in the pond is in a dry form.

   The regulatory agency for this unit is the Montana Department of Environmental Quality.

2. What year was the management unit commissioned and expanded?

   The Units 3&4 Scrubber Wash Tray Pond was commissioned in 1983. This unit was removed from service in 1995 and no longer receives scrubber water.

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash: (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other", please specify the other types of materials that are temporarily or permanently contained in the unit(s).

   Flyash and flue gas emission control residuals were periodically sent to this unit as it provided water to the scrubber wash tray system. There is a small amount of scrubber residue left in this unit.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

   This unit was designed by a professional engineer and the construction of the unit was under supervision of a professional engineer. Monitoring of the safety of the unit was also under the supervision of a plant professional engineer.

5. When did the company last assess or evaluate the safety (structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

   An assessment of the safety (structural integrity) of this unit has not been completed since original design and construction

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

   There has not been a safety inspection from a State or Federal regulatory official.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

   Not applicable.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

   The 3&4 Scrubber Wash Tray Pond has a surface area of 8 acres and a total storage capacity of 85 acre-feet. This unit is no longer in service, but it contains a small amount of flyash and flue gas emission control residuals. The volume of those materials is estimated at ~20% of the unit's capacity. The majority of this unit is incised, but the northwest side has a dike with a height of approximately 10 feet.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

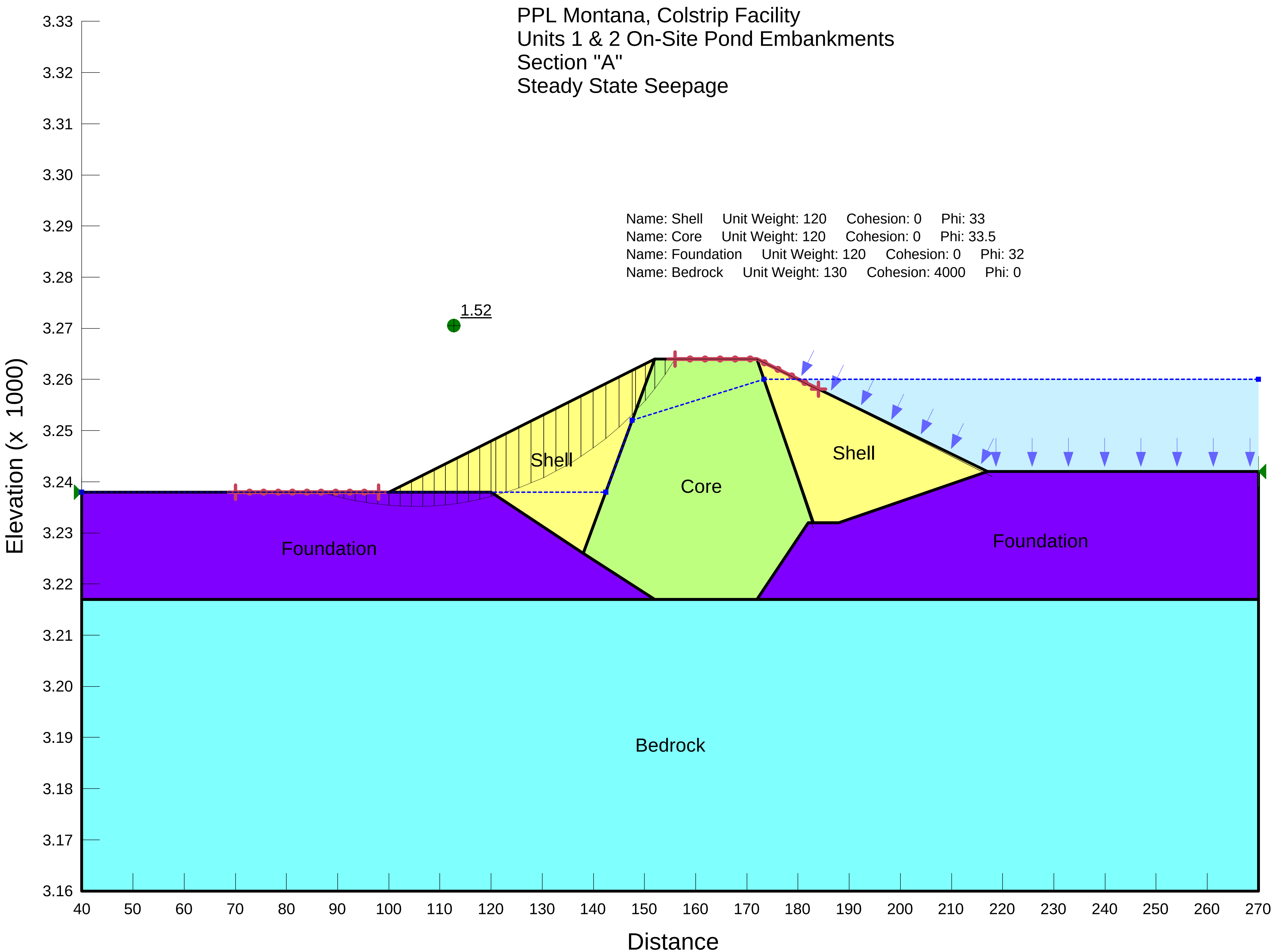
   There have been no releases from this unit within the last ten years.

10. Please identify all current legal owner(s) and operator(s) at the facility.

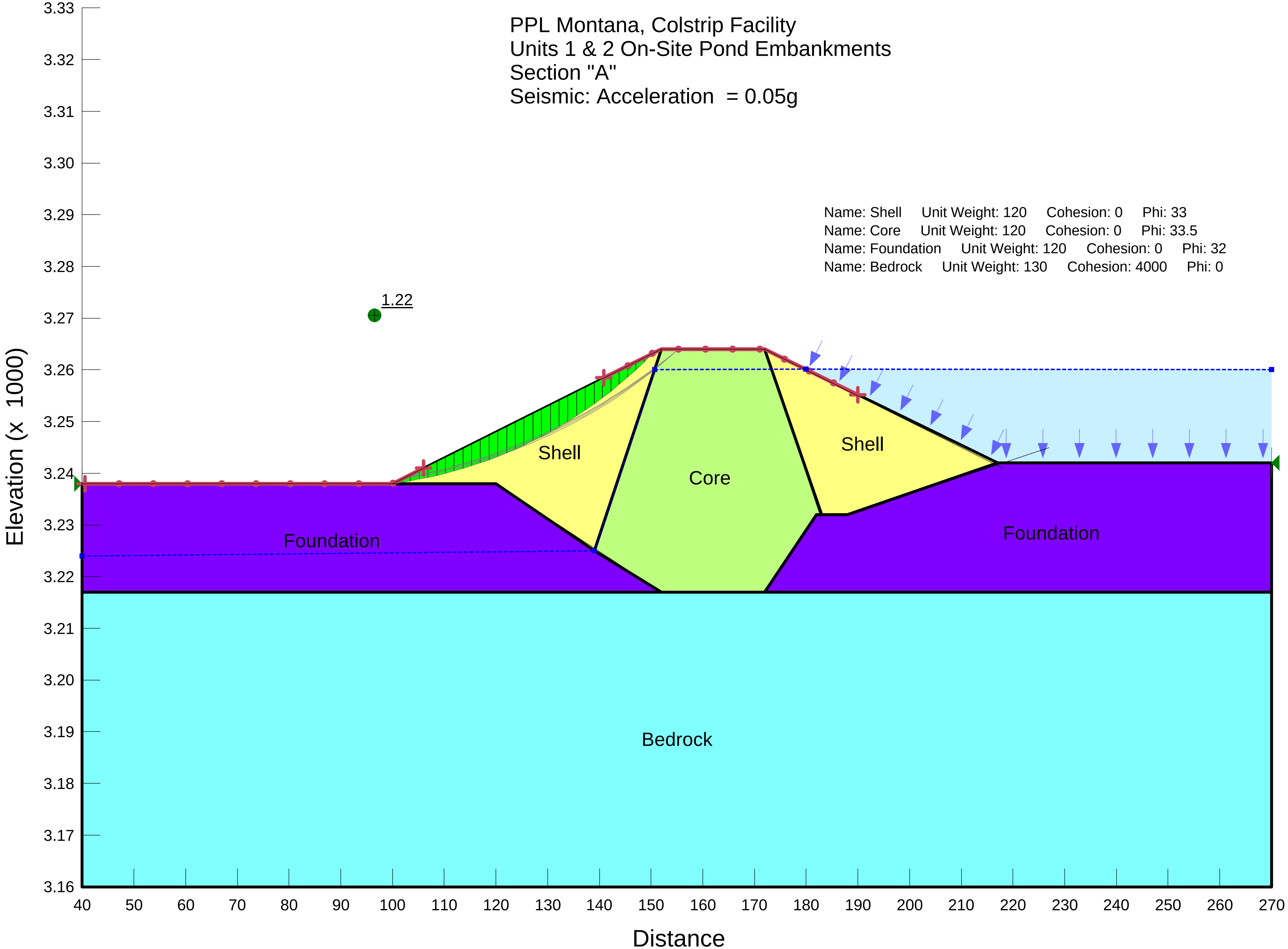
    PPL Montana, LLC – Owner/Operator
    Avista Corporation – Owner
    NorthWestern Energy – Owner
    Pacificorp Energy – Owner
    Portland General Electric - Owner
    Puget Sound Energy, Inc. – Owner

Appendix E

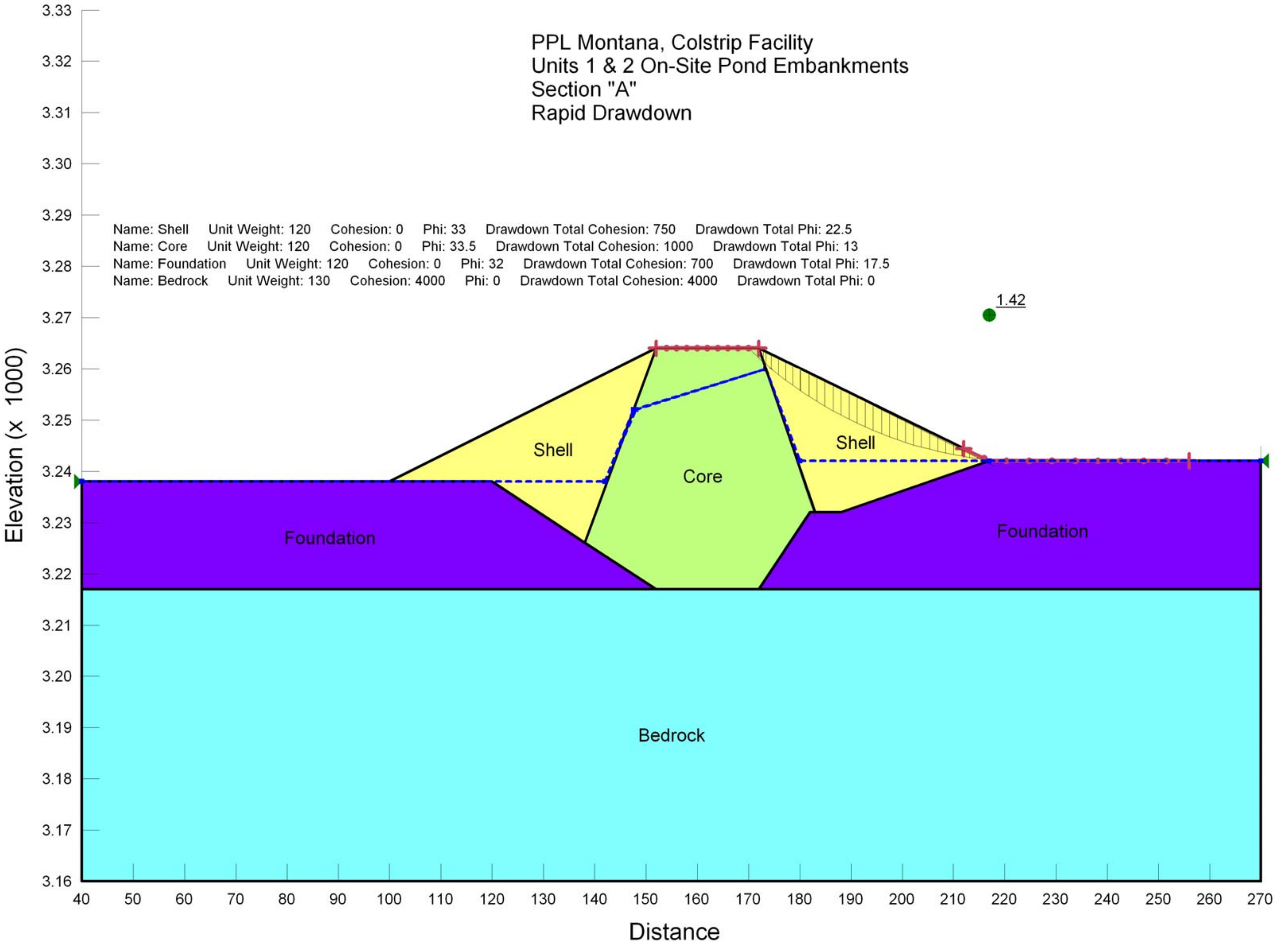
Stability Evaluation for Units 1 & 2 Bottom Ash and “A” Ponds



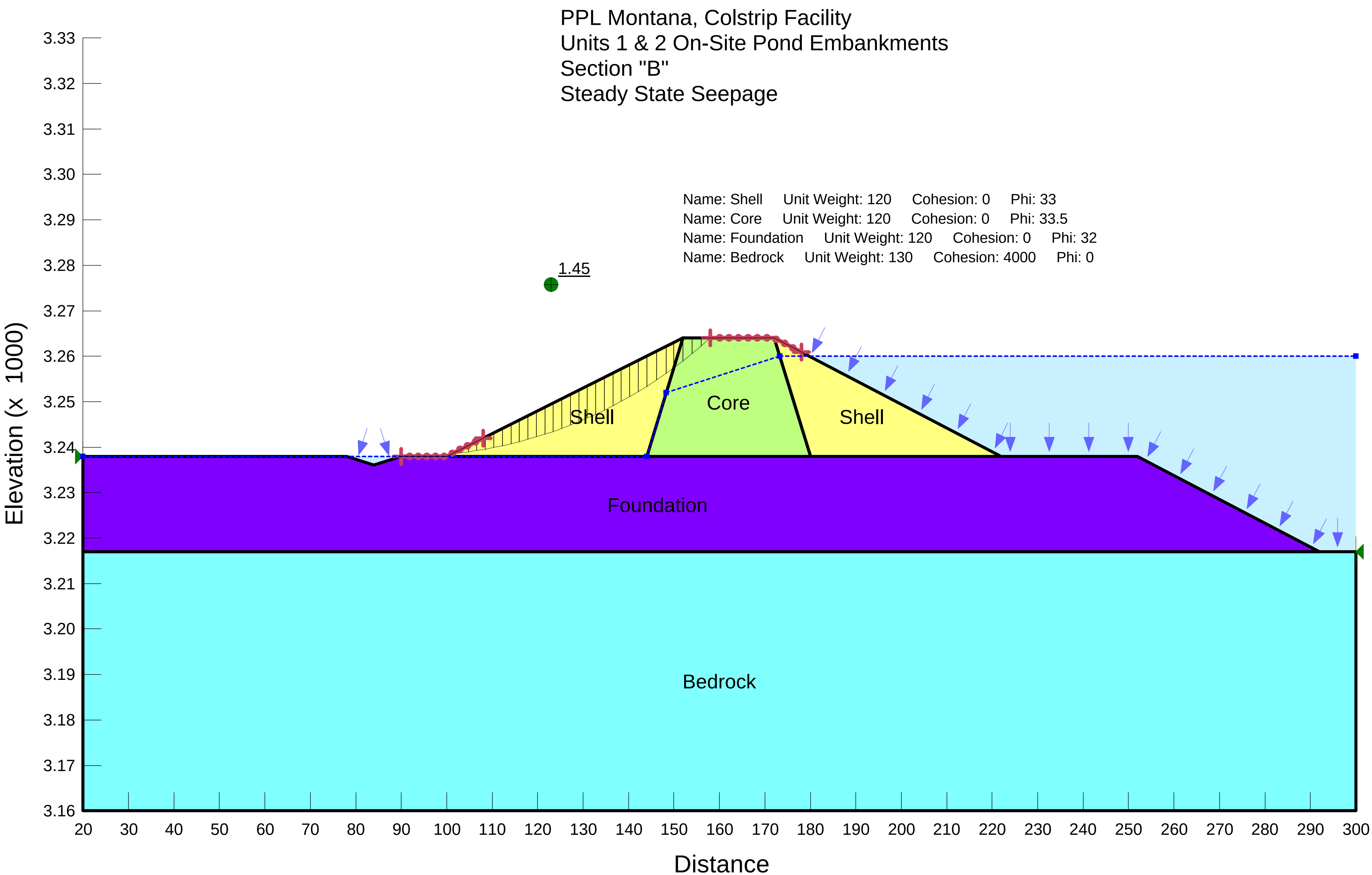
PPL Montana, Colstrip Facility
Units 1 & 2 On-Site Pond Embankments
Section "A"
Steady State Seepage
Name: Shell Unit Weight: 120 Cohesion: 0 Phi: 33
Name: Core Unit Weight: 120 Cohesion: 0 Phi: 33.5
Name: Foundation Unit Weight: 120 Cohesion: 0 Phi: 32
Name: Bedrock Unit Weight: 130 Cohesion: 4000 Phi: 0
1.52
Shell
Core
Shell
Foundation
Foundation
Bedrock
Elevation (x 1000)
3.33
3.32
3.31
3.30
3.29
3.28
3.27
3.26
3.25
3.24
3.23
3.22
3.21
3.20
3.19
3.18
3.17
3.16
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
Distance

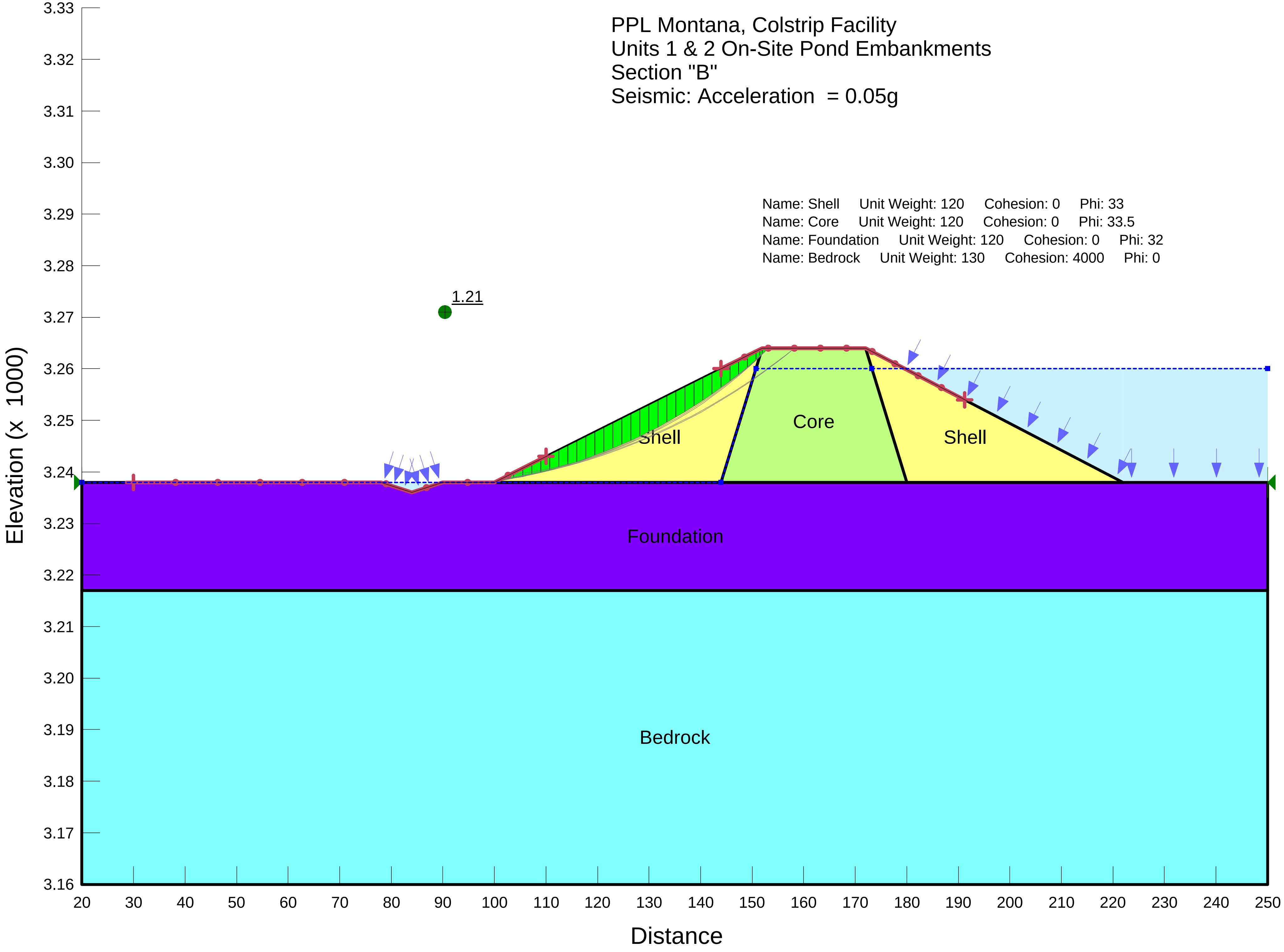


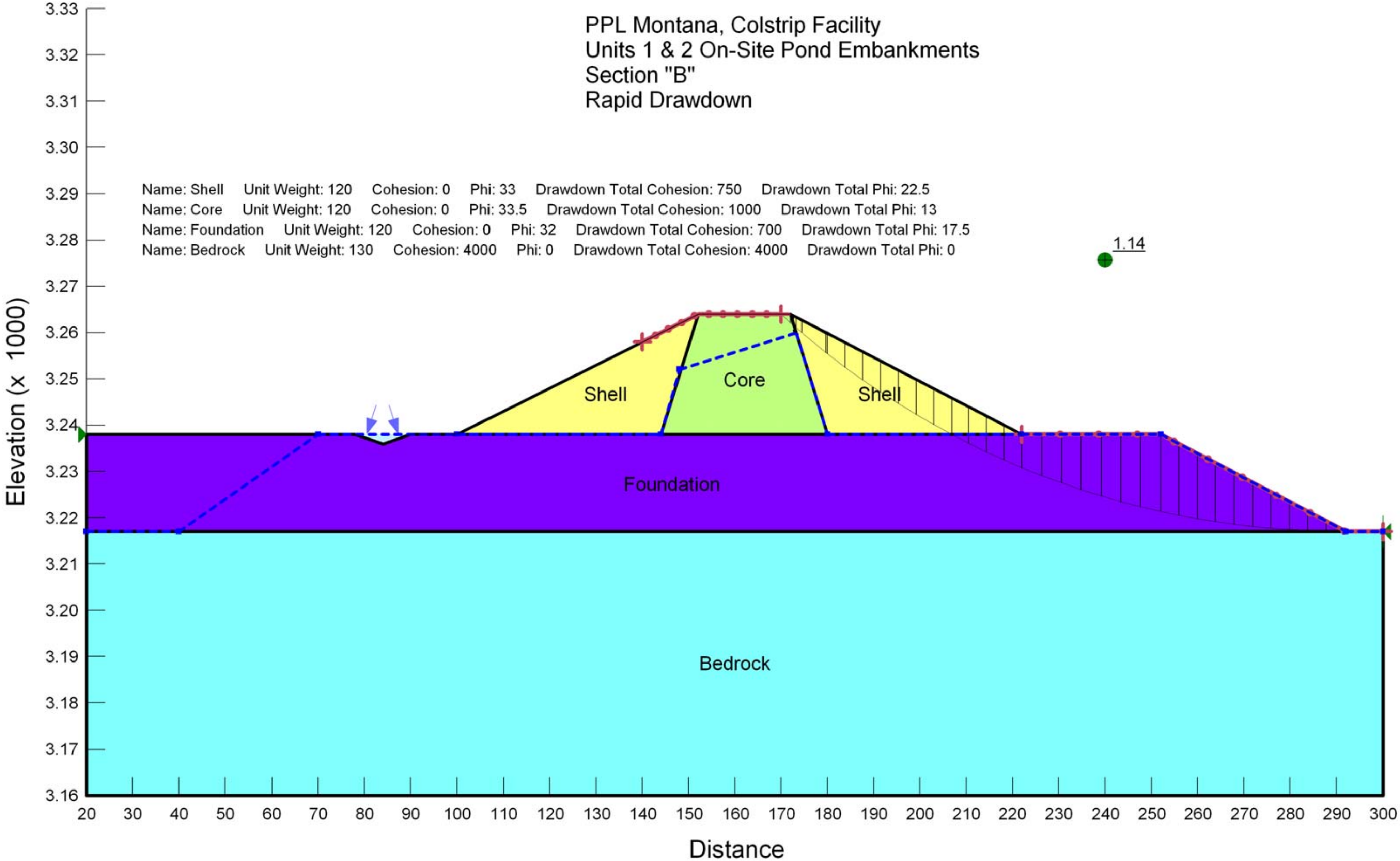
PPL Montana, Colstrip Facility
Units 1 & 2 On-Site Pond Embankments
Section "A"
Seismic: Acceleration = 0.05g
Name: Shell Unit Weight: 120 Cohesion: 0 Phi: 33
Name: Core Unit Weight: 120 Cohesion: 0 Phi: 33.5
Name: Foundation Unit Weight: 120 Cohesion: 0 Phi: 32
Name: Bedrock Unit Weight: 130 Cohesion: 4000 Phi: 0
1.22
Shell
Core
Shell
Foundation
Foundation
Bedrock
Elevation (x 1000)
Distance
3.33
3.32
3.31
3.30
3.29
3.28
3.27
3.26
3.25
3.24
3.23
3.22
3.21
3.20
3.19
3.18
3.17
3.16
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270



PPL Montana, Colstrip Facility
Units 1 & 2 On-Site Pond Embankments
Section "A"
Rapid Drawdown
Name: Shell Unit Weight: 120 Cohesion: 0 Phi: 33 Drawdown Total Cohesion: 750 Drawdown Total Phi: 22.5
Name: Core Unit Weight: 120 Cohesion: 0 Phi: 33.5 Drawdown Total Cohesion: 1000 Drawdown Total Phi: 13
Name: Foundation Unit Weight: 120 Cohesion: 0 Phi: 32 Drawdown Total Cohesion: 700 Drawdown Total Phi: 17.5
Name: Bedrock Unit Weight: 130 Cohesion: 4000 Phi: 0 Drawdown Total Cohesion: 4000 Drawdown Total Phi: 0
1.42
Shell
Core
Shell
Foundation
Foundation
Bedrock
Elevation (x 1000)
3.33
3.32
3.31
3.30
3.29
3.28
3.27
3.26
3.25
3.24
3.23
3.22
3.21
3.20
3.19
3.18
3.17
3.16
Distance
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270


PPL Montana, Colstrip Facility
Units 1 & 2 On-Site Pond Embankments
Section "B"
Steady State Seepage
Name: Shell Unit Weight: 120 Cohesion: 0 Phi: 33
Name: Core Unit Weight: 120 Cohesion: 0 Phi: 33.5
Name: Foundation Unit Weight: 120 Cohesion: 0 Phi: 32
Name: Bedrock Unit Weight: 130 Cohesion: 4000 Phi: 0
1.45
Shell
Core
Shell
Foundation
Bedrock
Elevation (x 1000)
Distance


PPL Montana, Colstrip Facility
Units 1 & 2 On-Site Pond Embankments
Section "B"
Seismic: Acceleration = 0.05g
Name: Shell Unit Weight: 120 Cohesion: 0 Phi: 33
Name: Core Unit Weight: 120 Cohesion: 0 Phi: 33.5
Name: Foundation Unit Weight: 120 Cohesion: 0 Phi: 32
Name: Bedrock Unit Weight: 130 Cohesion: 4000 Phi: 0
1.21
Shell
Core
Shell
Foundation
Bedrock
Elevation (x 1000)
3.33
3.32
3.31
3.30
3.29
3.28
3.27
3.26
3.25
3.24
3.23
3.22
3.21
3.20
3.19
3.18
3.17
3.16
20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Distance



PPL Montana, Colstrip Facility
Units 1 & 2 On-Site Pond Embankments
Section "B"
Rapid Drawdown
Name: Shell Unit Weight: 120 Cohesion: 0 Phi: 33 Drawdown Total Cohesion: 750 Drawdown Total Phi: 22.5
Name: Core Unit Weight: 120 Cohesion: 0 Phi: 33.5 Drawdown Total Cohesion: 1000 Drawdown Total Phi: 13
Name: Foundation Unit Weight: 120 Cohesion: 0 Phi: 32 Drawdown Total Cohesion: 700 Drawdown Total Phi: 17.5
Name: Bedrock Unit Weight: 130 Cohesion: 4000 Phi: 0 Drawdown Total Cohesion: 4000 Drawdown Total Phi: 0
1.14
Shell
Core
Shell
Foundation
Bedrock
Elevation (x 1000)
Distance